The Future of Floriculture
Greenhouse GROWER

DIGITAL DEEP DIVE

Automation

July 2025
A Meister Media Worldwide Brand
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Cover and Contents photo: Daniël Eikelenboom / PATS

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Originally published: May 27, 2025

How AI Is Transforming Greenhouse Operations

From collecting data for irrigation to early scouting for pests and diseases, AI is quickly becoming a mainstay in the greenhouse.

"By sampling a little bit of the airspace, you can tell a lot about the pests that are present. We were able to spot a pest sometimes three generations earlier than can be done with trap scouting efforts."

– Bram Tijmons
CEO and co-founder at PATS Drones

Daniël Eikelenboom / PATS

By Andy Wilcox

Artificial intelligence (AI) technology in agriculture is still in its early stages. Cannabis and leafy green growers were some of the first to adopt it, but the use cases for floriculture are already expanding. Not every AI system is designed to control the physical parameters of the grow house. New applications in pest scouting, yield forecasting, inventory management, and labor optimization are arriving almost daily.

AI in Daily Growing Operations

Like any new tech rollout, it hasn't been all roses. Challenges exist with data integration, system interoperability, and change management, which is a fancy way to say humans. A long list of movies has taught us to distrust smart machines.

Like many others, Costa Farms has been working with some of the new AI tools, finding what works for them.

"Change management is a key component of it, and that has probably slowed progress a little bit, but we've found some gains," says Chauncy Jordan, Vice President of Innovation at Costa Farms. "AI can automate redundant tasks. Counting and grading, those technologies have been around for a little while, and we're seeing some gains there."

With more growers trying AI tech, we asked Will Justis, Lead Software Engineer for Wadsworth Control Systems, about the ROI for these early adopters. Is anyone yet to the point of adding heat with these tools?

"Yes, growers are already seeing a net ROI with AI, whether that's with advanced control systems, computer vision, or planning tools. But there's inherent risk involved. AI for all industries is still in early development, and models are constantly being improved," Justice explains.

Jordan shares his view of the issue: "It's been key to quantify what's going to move the needle. For example, if a grower implements a vision-type system, maybe now they don't have to do germination checks. That's immediate labor reduction that is quantifiable very quickly. One grower's business case might be asset utilization. For us, it's how this affects labor and, in some cases, crop quality."

Inventory

Jordan and others have mentioned automating inventory as an early adopted task, what some might call low-hanging fruit. It's often a labor-intensive and error-prone process for many growers, especially in the potted plant and floriculture space.

"The AI can do a better inventory on a plug tray than a human because it's going to give you individual cell counts back. At scale, counting 72s versus what's actually there makes a difference. There's definitely meat on the bone with that. We found more use for it in young plants than finished plants at this point," Jordan explains.

Inventory management usually requires a walk in the greenhouse, counting and entering data into an app or a clipboard daily or weekly, whatever your frequency is. We asked Jordan, how has that changed now?

"Well, we're still having to do that to a point. The short-term goal is to be able to take data directly from the AI system into our ERP [Enterprise Resource Planning] system. We're not there yet, but I'm hoping that's in the short run."

Scouting

Costa Farms has been using the scouting capabilities of AI systems to augment its human talent and streamline efforts.

"Whether it can identify the problem based on what it has been taught or, more importantly, which one of these is not like the other — and where the grower needs to go look — from those standpoints, it's functional," Jordan says. Sometimes, it identifies the issue; other times, it flags a problem for a grower to go check out. "I would say the biggest thing

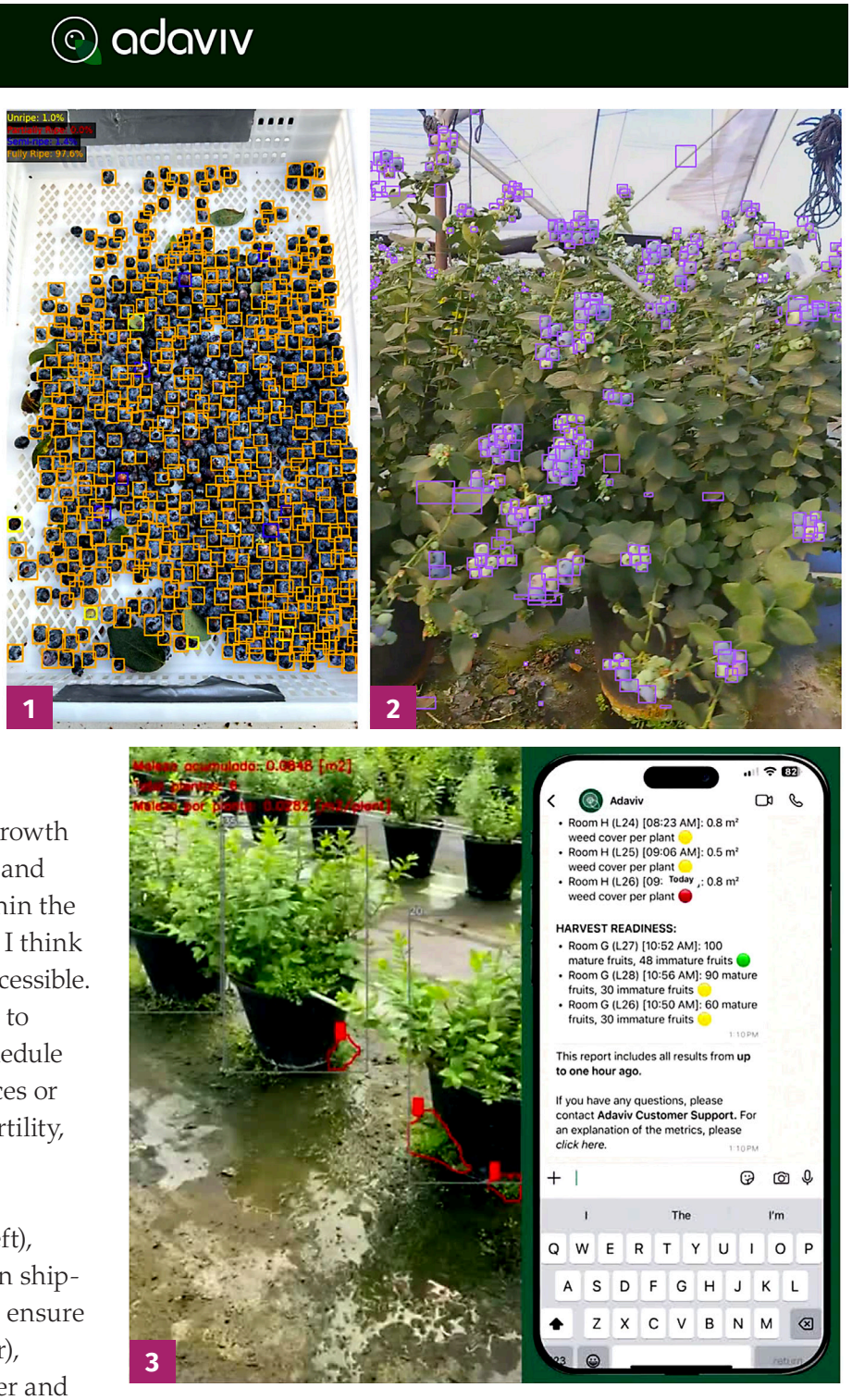
we've noticed is that it's starting to allow our people to focus on that 20% that we need to."

Growth Curves and Forecasting

"All that data is starting to come in," says Jordan. "The question is, what's actionable, and is it economically viable to act on it?" Growth curves and crop forecasting may provide information that a batch of ornamentals is three days behind, but if you operate on a weekly schedule, it may not be worth acting on. Or, it may be information for a future turn.

"Over time, you're building growth curves based on historical data and then looking for anomalies within the curves. We're not there yet. But I think that technology is absolutely accessible. It would give us the knowledge to explore why the production schedule is off. Are we overusing resources or underusing resources from a fertility, heating, or cooling aspect?"

Adaviv's AI system evaluates harvested blueberry baskets (left), providing real-time feedback on ship-ready fruit to reduce waste and ensure pack quality. In the field (center), mobile vision tools assess flower and berry development to predict harvest readiness and treatment effectiveness. A natural language chatbot (right) delivers these insights to managers and workers, guiding labor allocation and continuous quality improvement.



Adaviv's AI system evaluates harvested blueberry baskets (photo 1), providing real-time feedback on ship-ready fruit to reduce waste and ensure pack quality. In the field (photo 2), mobile vision tools assess flower and berry development to predict harvest readiness and treatment effectiveness. A natural language chatbot (photo 3) delivers these insights to managers and workers, guiding labor allocation and continuous quality improvement. | Adaviv proprietary information. Unauthorized reproduction or disclosure is prohibited.

When AI analyzes computer vision imagery, it can distinguish between different pest species.

"By sampling a little bit of the airspace, you can tell a lot about the pests that are present. We were able to spot a pest sometimes three generations earlier than can be done with trap scouting efforts," says Bram Tijmons, CEO and co-founder at PATS Drones. The system monitors the airspace rather than plant surfaces, using sophisticated cameras and AI to track flying insects. It can distinguish between different moth species based on size, flight patterns, and wing beats while accounting for geographical location and crop type.

Adaviv has been developing systems to make working in the greenhouse more efficient. "What we try to do is make the tech simple and agnostic to the crop," says Ian Seiferling, CEO and co-founder at Adaviv. "We're building a continuous improvement process, like a lean agent for the farm, specifically the cultivation side. In essence, we help growers standardize quality measurements with computer vision mobile apps and software we build. The concept is, how do we drive continuous improvement and reduce waste in the processes for these farms?"

Mobile phones are used to gather images for analysis by AI to provide insights on pests, weed pressure, and yield forecasting. A worker in the greenhouse pulls their phone out, logs into the app, snaps three pictures, and it gets uploaded to the data feed for the system.

"That's a feature I think has a direct application for floriculture. We provide growers a platform to digitize their plant health program. In weeding, for example, we'll help them assess the weed pressure throughout the farm, and then we help them allocate the labor," Seiferling says.

"We use computer vision to track and measure quality metrics that are very subjective and make them objective and scalable, then generate insights about where your labor needs to be." Seiferling explains that he views the power of AI, in that sense, is in making those insights more on demand, as opposed to a grower having to navigate a complicated dashboard and look at a bunch of reports. "You can now ask the system, what's my top priority today?"

Computer vision is no longer new in many greenhouses, but using AI to analyze the data gathered across the greenhouse and predictively make adjustments is still pretty cutting edge. Justis helps to lay out how AI solutions are transforming many areas of greenhouse operations: "One prominent area for AI is irrigation — precisely controlling how frequently to water specific growing zones to prevent exhausting water pressure or supply tanks."

Justis explains that AI solutions have greater potential value in optimizing larger systems with complex variables. "At the high end, computer vision is making its way into greenhouses to reduce human error. Cameras are being placed on individual plants, set up to look at groups of plants, or even put on wire systems to move from plant to plant. This vision data is used to inspect overall plant health, detect early signs of pests and diseases, adjust nutrient schedules, and forecast the optimal harvest time." GG

Andy Wilcox is a flower farmer and freelance writer with a passion for soil health, small producers, forestry, and horticulture. He and his partner run Stone's Throw Flowers, providing cut flower arrangements to retail and wholesale customers. Andy is an active member of the Farmer Veteran Coalition of Wisconsin.

Originally published: October 21, 2023

How Packaging and Labels in Floriculture **Are Trending Toward Automation**

As packaging evolves with the market, companies are looking for efficient ways to provide the best customer experience.

Costa Farms has 25 to 30 box sizes, but six sizes comprise most of their direct-to-consumer shipping.

Photos: *Greenhouse Grower*

By Julie Hullett

Packaging is a constantly evolving challenge for growers. This involves several aspects, including boxes, labeling, automation, and consumer experience. Packaging is the last step in a plant's life before it hits the retail shelves or arrives at a consumer's home. Therefore, there is a lot of thought behind the packaging process.

Direct-to-consumer (DTC) shipping is a newer aspect of the horticulture industry. Some companies offered this service before the COVID-19 pandemic, but it really ramped up once stores were forced to close. DTC has a unique set of challenges compared to wholesale partnerships.

Costa Farms, based in Miami, FL, focused on e-commerce after the acquisition of Delray Plants in 2017. Costa Farms' e-commerce division has doubled in size every year, according to Daniel Goldgewicht, Director of Operations, E-commerce. He says it is on track for 1 million shipments this year, in comparison to 800,000 shipments in 2022.

One major challenge with packaging is the weather, he says. The plants must be prepared for whatever Mother Nature throws their way.

Foliage plants awaiting packaging in the e-commerce facility at Costa Farms in Miami, FL.

The boxes have air holes that are punched in warmer seasons to get the air flowing inside the box and make sure the plant can breathe.

In the winter, potential cold damage is a problem, so there are no punched holes in the boxes. In fact, Goldgewicht says Costa Farms uses a software to calculate the temperature in various ZIP codes where the plants are headed. If it will be especially cold, workers place heat packs inside the boxes. There are heat packs that last 72 hours or 96 hours. However, some destinations are still just too far for sensitive varieties, such as cities west of the Rocky Mountains.

Justin Hancock, Senior Brand Marketing Manager for Costa Farms, says not all varieties are suitable for DTC shipping. For example, Hancock says some plants will stretch without light. Begonias are brittle, and it is impossible to ensure that they will be high-quality for the consumer who purchased them.

"There's a fair amount of work that goes into making sure we can do the individual plant varieties," Hancock says. "Some plants just aren't adapted to shipping no matter how carefully we package them."

Other challenges stem from the fact that plants are a live good, and may be sensitive to the wear and tear of shipping. There are many hand-offs while a plant is traveling with FedEx or UPS, for example, so the team at Costa Farms tries to ensure that the plant is protected for the trip. Goldgewicht says the top of the pot is covered in shrink wrap to make sure the soil stays in place during transit. Employees also place bamboo sticks and paper sleeves to protect the foliage. There are about 25 to 30 box sizes, but Costa Farms mostly uses six sizes for its common DTC shipments.

"There's a wide array of different solutions depending on what we're shipping, how we're shipping it, and where it's headed," Goldgewicht says.

Workers at Costa Farms place shrink wrap around the top of pots to keep the soil in place during shipping.

Opportunities for Automation

So far, most tasks related to packaging for e-commerce at Costa Farms are completed by workers. The tasks are not automated, but Goldgewicht says automation opportunities become more realistic as the e-commerce division grows in size. Costa Farms is exploring potential tasks that could be automated, not just from a cost point of view, but also to make their employees' lives easier.

"There are a lot of repetitive motions that go into packaging 3,000 to 5,000 packages per day," Goldgewicht says.

For example, covering the top of the pot in shrink wrap takes a lot of repetitive wrist motion. It is an ideal solution for protecting the plant so there is no soil spillage during shipping, but Goldgewicht says the ergonomics should also be good for the workers to reduce bending and twisting.

To move plants, the process is driven by conveyor belts. In the area where plants are shrink wrapped, there are three conveyor belts. Inside the processing facility, there are five conveyor belts. There are also up to four conveyor belts that carry plants into the trucks, Goldgewicht says.

At Costa Farms, e-commerce fulfillment centers around caring for their team and their customers, Goldgewicht says. Automation is practical when making tasks easier for their workers, including eliminating safety hazards. Automation also helps ensure all products are high-quality for consumers.

"Anywhere that we can automate repetitive motions to get consistent quality, that's where we want to dedicate our energy," he says.

Consumer Feedback

Costa Farms has five full-time employees on a consumer feedback team. They collect information from customer reviews, phone calls, and any feedback from retailers. That information is passed up the chain to Goldgewicht and his team to look for trends, such as heat damage to begonias.

The specifications of the plant may affect the quality through the shipping process. For example, Goldgewicht says if a plant is 49 inches tall but it's in a box that is 48 inches tall, the foliage may be damaged because it is bent over in the box. Pottery size also comes up often in consumer feedback. When Costa Farms introduces new pottery, workers send it with an extra layer of cardboard for protection against breakage.

"Sustainability is a big factor," he says. "It's really important to us and our customers."

Shrink wrap is the only component of Costa Farms' packaging that is not biodegradable. Within the last six months, the company stopped using bubble wrap on the pottery. Instead, they are using a paper-based product.

"We want to do everything possible to reduce our plastic usage," Goldgewicht says. "We're always looking at how we can reduce our footprint, especially on the packaging side. Shrink wrap is the only plastic component of our packaging. Everything else is paper based."

Trends in Labeling

Tony Cook, CEO of Great Lakes Label, says the industry is moving fast towards print apply labels, specifically for gallon-sized pots and below, such as quarts and pints. There is still a need for locking tags in larger products, such as woody ornamentals and 3-gallon containers and above.

For a longer profile or set of care instructions, Cook says the extended content label works well. There are two panels so you can print and apply the top section. The care instructions underneath are pre-printed. It is hinged on one side so it opens like a book, allowing the grower to put more information on one small footprint.

"Those two labels are married together," Cook says. "It's kind of like an instant redeemable coupon that you peel off."

Cook says the Lagit from Great Lakes Label addresses a common need that growers face. For vegetables, consumers want to take the tag with them. Many vegetable varieties are hard to distinguish when they are small, so consumers plant them and don't know which is which until later in the season. Gardeners will insert the pixie stick in the ground by each row of plants, so they can tell which variety is planted there.

"We still like the concept of being able to print and apply with automation. We developed a product called the Lagit. It is a combination of a label and a tag," Cook says. "There's a corner of the label on the face of the pot that has a 'lift here' area to peel it up. It's a thicker material, and when you peel it off, it comes in the shape of one of those pixie sticks, and consumers can put it in the ground."

The Lagit was released two years ago and has been commercialized in the last year. So far, feedback has been positive. Great Lakes Label is wrapping up a Lagit trial with end consumers at Lowe's.

Packaging trends continue to adapt over time, but industry leaders are at the forefront of innovation as the market changes.They are adapting to the needs of their clients. GG

Julie Hullett is a former Senior Editor of *Greenhouse Grower*.

Originally published: July 25, 2023

Grower-to-Grower Advice on How and Why to Invest in Greenhouse Automation

What type of automation is best for your company? This question was among others addressed during a panel discussion at Cultivate'23 featuring growers from three diverse operations.

By Brian D. Sparks

No matter the scale of your operation, automation can be a worthwhile investment for many reasons. But what type of automation is best for your company?

This question was among others addressed during a panel discussion at Cultivate'23, where growers from three diverse operations discussed the different variations of automation they have chosen to implement in order to drive growth and increase employee satisfaction. Moderated by Rob Lando of AdeptAg (and new Chair of AmericanHort's Board of Directors), the panel included Brian Groves of Panoramic Farms in North Carolina, Mike Miller of Decker's Nursery in Ohio, and Bud Summers of Everde Growers, which has multiple locations across the U.S.

"If you're not a low-cost producer in today's growing environment, you're not going to be profitable," said Lando in kicking off the discussion. "Labor costs in our industry have increased 25% since 2019, and while automation isn't the answer, it should be part of the solution."

Robotic arm in greenhouse | phonlamaiphoto-stock.adobe.com

From there, the discussion veered in several directions, from how each company decided when was the right time to automate, to how much automation is necessary. Here are a few insights from the growers on the panel, who represented a range of company size and crops grown.

"We use our northern California location to trial any new piece of equipment we're looking at, then determine how it might fit at any of our locations," Summers said. "Some of it may be plug-and-play, but because we're growing on many different sites, we need lots of variety."

"We started automating in 2009 and 2010 because we wanted to be a different company coming out of the recession, and automation was our path," Miller said. "Our goal is to eventually have our employees never have to touch a pot."

When asked when it is appropriate to look for automation solutions, each grower had a unique response. "If you want to be in business 10 years from now, you need to take that step," Miller said. "You don't need to do it all at once, but you need to start somewhere because I can guarantee your competitors are doing it."

At Everde Growers, Summers said labor availability and cost were a deciding factor, as well as plant quality. "You need to know your product quality expectations," he said. "What are you trying to gain with automation?"

Groves noted that the investment in automation certainly costs money, but it can pay off in many ways, including attracting the next generation of ownership.

Capturing and tracking your production costs is critical both before and after you invest in automation, according to Groves. "You need to know your current labor costs so you can set realistic expectations on how much you can save," he said. In addition, Miller noted that tracking your costs can help you fully understand how your team is performing.

Summers noted a number of factors that need to be addressed when measuring your costs, from safety to preventative maintenance. "You need to define your processes from input to output, and take repeated measurements over weeks and months," he said. "Also, do your raw materials or containers need to change if you're adding new equipment?"

Return on investment was a big part of the discussion, with Lando suggesting the industry needs to consider the European mindset of allowing a greater ROI window, as much as eight years. “It’s a more realistic time frame, but you also have to be right,” he said. While most of the panelists used a shorter window, Miller noted the return you’re aiming for doesn’t always have to be financial. “You should also consider the environmental impact or the ease of implementation,” he said.

There may be low-hanging fruit you can identify to get the automation process started, Miller said. “Look at the area of your business with the biggest labor consumption and whether you can mechanize it,” he said. “We started with pot handling and plant trimming, and evolved from there.”

Summers noted that early wins, even if they’re small, can be the most rewarding. “Success begets success, and if you get an early win, share those savings with your employees to incentivize them,” he said. “

Making a sizable investment in a piece of equipment you’re only going to use for a short time each year can be daunting, which is why Groves says when Panoramic Farms uses its potting machine, for example, it goes all in. “We want to show our team we’re getting maximum use of our equipment at our busiest time.”

What advice did the panelists have, and what would they do different? Groves emphasized the importance of communicating your goals and expectations to your team as clearly as possible, while Miller said you need to look at the big picture and make sure whatever technology you’re adding fits with your goals as a company over the next few years.

Summers offered some great closing thoughts: “Not everyone likes change, so you may need to have some hard conversations with your team,” he said. “Sometimes it’s all about attitude, so be willing to move people around if it becomes a roadblock.” GG

Brian Sparks is Editor of *Greenhouse Grower and GreenhouseGrower.com*

Originally published: November 13, 2024

New Research into Nursery Industry Automation to Be Funded by $1 Million Grant

The funding for research into automation technologies is made possible by the USDA National Institute of Food and Agriculture.

By UF/IFAS News

Imagine a future where nursery growers can effortlessly manage their plants with cutting-edge automation technologies, using potting or weed-spraying robots, instead of having to dig each hole or spray each pot by hand. With the help of a $9.8 million grant from the USDA National Institute of Food and Agriculture (NIFA), this vision is becoming a reality.

The University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) will use about $1 million of the grant to lead research and development to tackle the labor challenges faced by the nursery industry. UF's role in this grant includes evaluating herbicide, pesticide, and fertilizer application equipment and testing people's perceptions of and willingness to adopt new strategies related to automation.

The grant will address critical labor challenges within the nursery industry, says Chris Marble, Associate Professor of Ornamental and

Nixia Martinez working in her plant nursery, Nixia's Exotic Plants, alongside her parents (L), and potted plants in a nursery (R) | UF/IFAS, Tyler Jones

Landscape Weed Management at the UF/IFAS Mid-Florida Research and Education Center.

"The big goal is to affect change. We want growers to adopt these different automation practices, but mostly, we want to give them information to even consider these changes in the first place," he says. "We want them to take incremental steps so they become more profitable and more sustainable, and it helps the industry as a whole."

The nursery industry, particularly container nurseries, faces significant hurdles due to labor costs and availability. Unlike more traditional agricultural sectors that have largely adopted automation, such as peanuts, cotton, or corn, nurseries deal with a diverse array of plants, making automation more challenging.

The primary goal of the five-year grant project, led by North Carolina State University, is to explore and implement various types of automation – from timed sprayers to robots – within the nursery industry.

The project will look at the return on investment of large-scale potting machines, automated sprayers, and other innovative technologies. By incorporating the expertise of economists, engineers, and social scientists, the project will provide comprehensive solutions that are both economically viable and widely adoptable, Marble says.

UF/IFAS, via Marble, will lead the Extension efforts nationally, organizing field days across the country to demonstrate the benefits of automation. These events will provide hands-on experiences and showcase successful case studies to encourage adoption among nursery owners.

Another initiative within the project will be led by UF/IFAS Professor Laura Warner, of the Agricultural Education and Communication department, investigating the perceptions and barriers to adopting automation technologies. Understanding the concerns nursery owners and employees have with adopting new technologies, such as incompatibility with existing nursery infrastructure, is crucial for developing strategies that facilitate smooth transitions to automated systems for nursery owners and employees.

"Is there concern that different types of automation might cost someone their job? That's what we want to find out," says Marble.

Incremental steps, from simple upgrades like switching from granular hand shakers to sprayers to large-scale implementations of potting machines, will be explored.

At the end of the day, automation decisions must be made on a case-by-case basis, says Marble, since each nursery has unique needs and concerns. Researchers are sensitive to these needs as they proceed with the study and will incorporate these challenges into their study results.

"Each nursery is so different," he says. "You can go to a nursery up the street and some automation might be very beneficial to them, but for the one next door, it might not make sense." GG

The news source of **University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS)**.

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