# How Soon Will You Be Using AI

## in Controlled Environment Production?

**Before investing in AI, growers should have an environmental control system that enables them to control temperature and humidity.**
*(Photo: iUNU)*

*Controlled environment growers are using artificial intelligence to save energy, identify pests and diseases, maximize production space, and increase margins and profits.*

**BY DAVID KUACK**

Increasingly controlled environment growers are hearing and reading about the use of artificial intelligence (AI) to produce horticultural crops. While some growers may think the use of AI is a long way off for their own operation, other growers are already taking advantage of the technology.

"AI is a broad term that can be applied to a wide group of strategies in optimizing a controlled environment operation," says Vince Harkiewicz, co-founder and CEO at Grownetics in Boulder, Colorado. "AI is quickly becoming just another tool in the growers' tool box."

He says AI applies to understanding crop growth factors and the plants themselves. It can be applied to the production facility, including control systems, when to turn lights on and off and when to open and close vents for energy savings and optimal plant growth. This technology also applies to identifying pests and diseases.

Adam Greenberg, CEO at iUNU in Seattle, Washington, says one misconception growers may have about AI is that it is the same as automation.

"Automation has discrete value," Greenberg claims. "Putting in a transplanting line, for example, would have a capped return on investment.

"AI can continue to add increased value over time because it learns. AI can improve and refine its own processes internally as it collects more information as opposed to automation, which stays stagnant."

### WHO CAN TAKE ADVANTAGE OF AI?

Data plays a critical role in the implementation of AI, but not all data is created equal.

"Larger growers tend to collect more data, but it's not the amount of data, but what is done with it that is important," Greenberg says.

"Collecting a lot of data doesn't really add any value if it's not utilized well. All large controlled environment growers have some type of environmental control system that collects data. In addition, many growers are also collecting manual data that is easily available to them. This may not be the right type of data to drive value."

Greenberg says some data points are more valuable than others. Temperature data points, for instance, are important, but do not tell growers how their crops are growing.

"One of the most valuable data points that iUNU customers benefit from is daily growth rate. We deliver the daily growth rate so growers can see how a crop is doing in near real time."

Growers who have more advanced production systems tend to incorporate more sensors in their operations. "These growers may generate a lot of data, but it is not being stored and aggregated," Harkiewicz says. "The data being collected by sensors is being used for real time monitoring and alerting to get a sense of what is going on. Growers may have an advanced control system, but there is no automatic correlation of the data to the plants. Without that there is no AI happening. It would take a full time data scientist or dedicated horticulturist on staff just to analyze the data."

iUNU is working with controlled environment growers in all crop sectors, including ornamentals, vegetables and cannabis.

"In general, the higher the value of the crop, the faster the adoption of AI," Greenberg says. "We see produce and cannabis having a faster adoption cycle than the ornamental horticulture industry."

According to Greenberg, AI can also affect ornamental horticulture dramatically due to the industry's tighter margins. "A 3 to 5% increase in margin for an ornamental grower is extremely significant."

He says AI has two values — one around scale and the other around precision. "The larger an operation, the more obvious the ROI for AI becomes because standardization allows for an increase in scale while keeping up quality. Small mom-and-pop operations are using AI for high-value crops that need to be more precise. They use AI more for precision and quality and not for scale."

For growers who don't have an environmental control system and lack the ability to control temperature and humidity, Greenberg recommends they focus on installing a system that provides this control prior to investing in AI.

"Once growers have this control then they can use AI to drive valuable outcomes regardless the size of the operation," he says. "Growers without a control system could still play around with AI, but the ROI is going to be a lot lower."
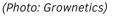
### MAXIMIZING DATA USE

Harkiewicz says the majority of controlled environment growers are not taking advantage of the data they have available to them.

"Generally, controlled environment growers have a minimum number of sensors available to run their greenhouses to operate the cooling, heating and shading," he says. "There is a minimum amount of data that they can take advantage of. But this data is not going to give them an understanding of what is really going on.

"We work with our customers to develop a sensor plan that maps the microclimates in their cultivation facility, including data on root zone conditions. We are trying to understand the crop yield inputs that include the environment around the plant canopy and the root zone and the tasks done to those plants. We use a unique 3D environmental mapping system. When plants are grown under lights or on multiple levels, there is a stratification of the environment and there is going to be a different climate above the canopy then there is below the canopy. We want to try to mitigate that. The 3D environmental mapping can help growers understand what's going on above and below the canopy."



**Using AI offers controlled environment growers an opportunity for more sophisticated control that can increase efficiency by more than 30-40 percent compared to basic control adjustments.**
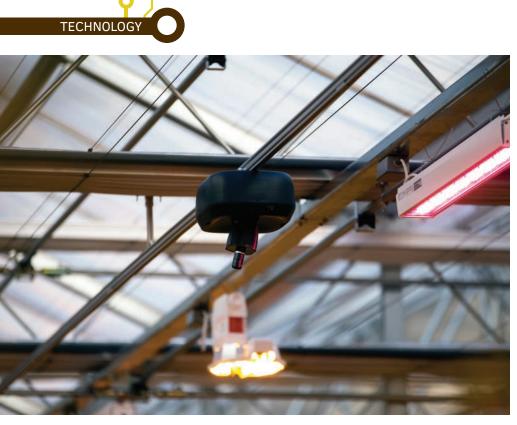*(Photo: Grownetics)*



**The benefits of AI extend beyond the production facility allowing its users to do sophisticated statistical analysis on yield outcomes not usually capable with traditional data-driven growing.**
*(Photo: Grownetics)*

Using data more effectively with AI extends beyond the benefits in the production facility. "Once that data is linked to the plants, then we can start to do some very sophisticated statistical analysis on yield outcomes," Harkiewicz says. "Growers rarely have the time to do this analysis with every harvest."

Harkiewicz says the focus currently in horticulture is primarily on yield and maintenance of facility equipment. Not enough attention is being paid to new methods in data-driven growing.

iUNU's AI system, called LUNA, incorporates video cameras that travel through a production facility on rails.
*(Photo: iUNU)*

"Most growers are very reticent to believe that AI can solve all these issues," he says. "There is a huge value proposition just around data-driven growing and taking advantage of data in a much more comprehensive strategic way across the entire operation. That is a big thing missing in the horticulture industry. This industry can be much more sophisticated around data as a whole. Data science and AI are sophisticated tools with a wide range of applications."

> "Using data more effectively with AI extends beyond the benefits in the production facility."

## IMPROVING RESOURCE EFFICIENCY

Harkiewicz says one of the most interesting aspects of applying AI to CEA is using AI to optimize energy efficiency during cultivation.

"CEA can supplement large scale industrial agriculture, but when plants are grown in a controlled environment, growers are always dealing with energy consumption," he says. "Traditional control models which turn fans on and off are very rudimentary and use set points. Beyond that there is so much opportunity for more sophisticated control that increases the efficiency by more than 30 to 40% compared to what is being accomplished with basic control adjustments. There is a lot of this being done already with HVAC for traditional commercial buildings. Instead of turning equipment on and off, it is being ramped up and down more subtlety. Not only does this give a more consistent ability to hit set points, but it also uses much less energy.

"Between using environmental control equipment more efficiently and sophisticated lighting strategies for supplemental lighting or unique lighting recipes, there are many more opportunities to reduce energy consumption in controlled environment facilities. This is where the immediate future is for the application of AI beyond just machine vision and yield improvements. Machine vision takes images or video and interprets what's in those still images or that video feed, which includes identifying pest- and disease-related issues."

The iUNU AI system, called LUNA, incorporates video cameras that travel through a production facility on rails.

"In greenhouses, adoption of our system is being done by data-driven growers who have control systems," Greenberg says. "Growers with a control system have some type of scale and care about precision because precision has an impact on margins.

He says the LUNA system can also do real time space monitoring across the entire operation, which allows growers to see where everything moves daily and to automate their forecasts in real time. The result is increased crop turns, increased sell through, increased margins and increased revenue. gpn

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