October 16, 2020

The St. Paul City Council
St. Paul, MN

Dear council members,

We are seeking a path to move forward with our new and innovative hydroponic container farm in the city of St. Paul in order to serve our local community in which we live and work. We are passionate about providing our fellow citizens with fresh produce year-round, especially during a time when climate change and natural disasters are compromising the yield of traditional farming produce. To serve the needs of our densely populated city, we are excited to deliver a viable solution for a sustainable food model. This new technology requires a new way of thinking. We are asking for support to keep our business in St. Paul by reconsidering the classification of our farm as an agricultural facility rather than a storage container, which is demonstrated in the attached photos and supplemental information.

In response to our recent appeal hearing on October 6th, we wish to provide clarification that we certainly are not trying to get around city rules and ask for forgiveness rather than permission. Our team is new to the world of small business, and we fully admit to a lack of knowledge of business protocols in St. Paul. We honestly believed we were following the correct channels, registering our business with the state and incorporating as an LLC, securing a commercial lease, and working with a licensed electrician to abide by city code and permit rules. Upon receiving our code violation, we made countless attempts at communication both via phone and email to learn what steps our business needed to take, but calls and emails went unanswered; we had already made a bad impression, with assumptions being made about our intent. Our hope now, as it always has been, is to work with the city to be compliant with whatever zoning categorization allows our farm to remain in St. Paul.

We have been humbled by the outpouring of local support. St. Paul residents are as excited about hyper-local produce as we are, evident by comments in online channels. Selected comments are attached in Appendix B for your reference.

As we look at other innovative businesses in the area, precedents have been set for acceptance of new and novel ideas. Bang Brewing Company in St. Paul, for example, appears to be a grain bin from the outside but is in fact a brewery on the inside. The storage "bin" was reimagined and is now highly accepted despite its outward-facing appearance. Another example is Frisk Fra Boksen, a business that also operates a hydroponic container farm in Ramsey County. The city of Shoreview modified City Code to specifically allow for hydroponic container farming. One thing we are proud to have in common with these businesses is a focus on the "Quadruple Bottom Line" approach, meaning MN Acre Farms is adopting a business model designed to improve the health of the planet and community

wellbeing. We are asking to be judged by the products we produce inside our container so that we may serve our local community in the way we envisioned.

Included in the Appendices below is extensive supplemental information:

- Appendix A shows images of the MN Acre Farms facility, both interior and exterior, as well as operational images from the manufacturer, Freight Farms.
- Appendix B includes selected comments from St. Paul residents in social media fora, expressing support for MN Acre Farms and pleading for innovation.
- Appendix C links to a PDF of the complete technical manual for the "Greenery" container farming system as produced by the manufacturer, Freight Farms.

Professionally yours,

John Cannon, Vanessa Cannon, Mitchell Karstens, and Tyler May
Minnesota Acre Farms, LLC

Appendix A:

Figure A1: Exterior photo of the MN Acre Farms hydroponic container farm as currently placed at 408 Snelling Avenue South in St. Paul.

Figure A2: Interior photo of the MN Acre Farms hydroponic container farm on the morning of placement (August 28, 2020). The growing racks are apparent in the rear. The boxes contain the structures for the planting rows and hydroponic circulation tubing. The nutrient delivery pumps and seedling table are at left. It is important to stress that the final assembly of the farming system requires electricity and so we have as yet been unable to take these steps.

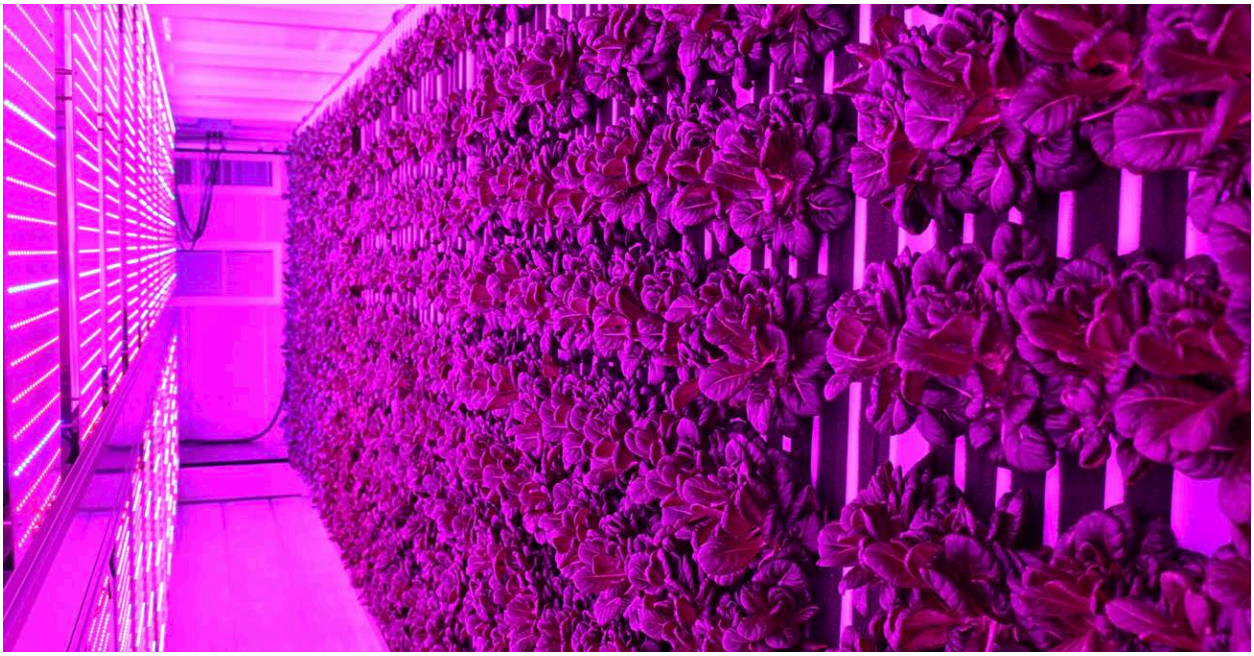


Figure A3: True color image of the interior of the "Greenery" farming system in operation. The red and blue LED light banks deliver photons of specific energies that catalyze the red and blue chlorophyllic reactions, resulting in the overall pink illumination. Notice the hundreds of healthy plants which grow in the vertical rows of each growing rack. The "Greenery" system can enable an astounding 8,800 living plants to grow within at a given time. Image drawn from the website of the manufacturer, Freight Farms (www.FreightFarms.com).

Figure A4: Two images of farmers tending to live produce in an operating "Greenery" farming systems. The upper image highlights the fully operational nature of this agricultural production facility; note the electrical system, the HVAC system, and the hydroponic water delivery system. Image drawn from the website of the manufacturer, Freight Farms.

Appendix B: comments from St. Paul citizens who support the ideals of the MN Acre Farms urban agricultural facility, extracted from Nextdoor.com

Lori Youngren
Randolph Hamline • 1 day ago

Hearing Officer says Mac-Grove hydroponic container must go. I read the above-entitled article in the October 14 edition of our neighborhood paper, "The Villager" and was dumbfounded! It states that, "The fate of a large hydroponic container used to grow food will be decided by the St. Paul City Council on October 21." Unless the council reverses the recommendation of a legislative hearing officer, the owner will have until October 30th to remove the container.

Our Mayor and City Council members constantly write about their efforts to bring new businesses to St. Paul with an emphasis on "green" businesses. The article further states that "the container is designed to grow vegetables and fruit year-round in a manner that uses electricity and water efficiently", but that such a container is classified as a storage container, rather than an agricultural business. "Legislative hearing officer Marcia Moermond said the issue is not how the container is used, but its adherence to city building and zoning regulations." What?

I'm not an expert on hydroponic containers, nor do I have a stake in this business, but it is a business that I would personally patronize and would love to have in my neighborhood! At a time when our supplies of fresh produce are threatened by wildfires in the west, flooding in the south and widespread cases of salmonella on farms throughout the country, we should welcome innovative growing operations such as this rather than prohibiting them in our city.

The article reports that there are 500 such containers around the world and are allowed in other cities, including Minneapolis! That St. Paul would refuse to let a "green" business operate in our city is confusing and short-sighted. This is the future, folks!

Please contact our council members and urge them to reverse the recommendation of the legislative hearing office and allow this business to operate in our city. Failure to do so will just send the business, and potential customers like me, to Minneapolis ... a scenario that is happening all too frequently.

Paul Ogren • Randolph Hamline

The city needs to recognize this as more than a storage container. Maybe they should license this as a business and set up some rules about where it can be located.

1 day ago **Like** **Reply** 7

T

Toni Johnson • Randolph Hamline

This is a business worthy of support. I hope a solution can be found.

1 day ago **Like** **Reply** 3

S

Suzanne Anderson • Macalester Groveland

Is it possible that the issue is with the way the container is placed? For example, could it be encroaching on easements, not adhering to space requirements, etc? I think I walked by it the other day and it is placed right next to the electric pole and I wondered if that wouldn't prohibit an access of a maintenance crew. (Btw, I love the idea of urban farming. I hope that the issue is solved)

Edited 1 day ago **Like** **Reply** 5

L

Lori Youngren • Randolph Hamline

I don't think that's the issue. The article states that, "Such containers are classified as storage containers by the city and are considered temporary.". I interpret that to mean that it can only remain in it's current location for a set period of time and, apparently that time is up on October 30. I hope the issue is resolved too -- I would definitely patronize a business like that!

Edited 1 day ago **Like** **Reply** 3

L

Linda Limback • Lilydale

Maybe we have room for you here in Mendota Heights. Would sure be great to welcome a hydroponic nursery here.

13 hr ago **Like** **Reply** 2

Appendix C: the technical manual for the "Greenery" hydroponic container farming system, which provides additional images and supplemental information.

Published by the manufacturer, Freight Farms.

GREENERY

2019
PRODUCT BOOKLET

GREENERY

GREEN • HOUSE NURS • **ERY** MACHINE • **ERY** PLANT FACTO • **RY** LABORATO • **RY**

The Greenery represents a new category onto itself, a distillation of an idea into a core, governing concept. With the opportunity for countless unique applications, the Greenery cannot be confined to just one category: greenhouse, nursery, laboratory...none can capture the Greenery's full potential.

The Greenery is a vertical hydroponic farm that thrives within an insulated, custom-built shipping container. It is possible to walk past without realizing that the unassuming green and white container houses a verdant world where the weather is always warm and the sun never sets. Unlike traditional farms, the plants in the Greenery grow vertically indoors without soil:
The plants obtain all their nutrition from water and their light energy from powerful LEDs. This independence from land, climate, and season allows the Greenery to bring the power of food production anywhere in the world– its modular design means it can easily traverse the globe by land and sea before arriving at its new home.

PERFECT DAYS

The Greenery's climate control components work together to recreate an ideal spring day, everyday. As a result, plants can thrive inside the container regardless of the external environment–harsh climates, tight urban centers, and extreme weather conditions have no effect on the plants growing inside.

A. Insulation

The Greenery's shell has a Department of Energy Insulation rating of R-28. This means the Greenery can maintain an average internal temperature of 70ºF in extreme climates ranging from -40ºF - 130ºF and a variety of inclement weather conditions.

B. Climate Control

The 36,000 BTU Bard HVAC unit automatically cools the Greenery based on farmhand® programming. An integrated economizer saves energy by drawing in cool outside air when appropriate, doubling as an intake fan.

C. Dehumidifier

Integrated within the Bard unit, the Greenery's dehumidifier maintains optimal in-farm humidity levels. Condensate is captured and recirculated back into the water tanks at up to 1.88 gallons/ hour, decreasing the farms overall water consumption.

D. Airflow Ducts

Two fans power on-panel air ducts to distribute cool, CO_2-enriched air evenly through varied-sized holes in the anti-microbial material, creating uniform airflow in the entire container.

E. CO_2 Regulator

A precision regulator with a safety shut-off feature provides plants with the CO_2 needed for photosynthesis. CO_2 is fed directly into the airflow ducts and permeates into the main cultivation area.

B. C.

A

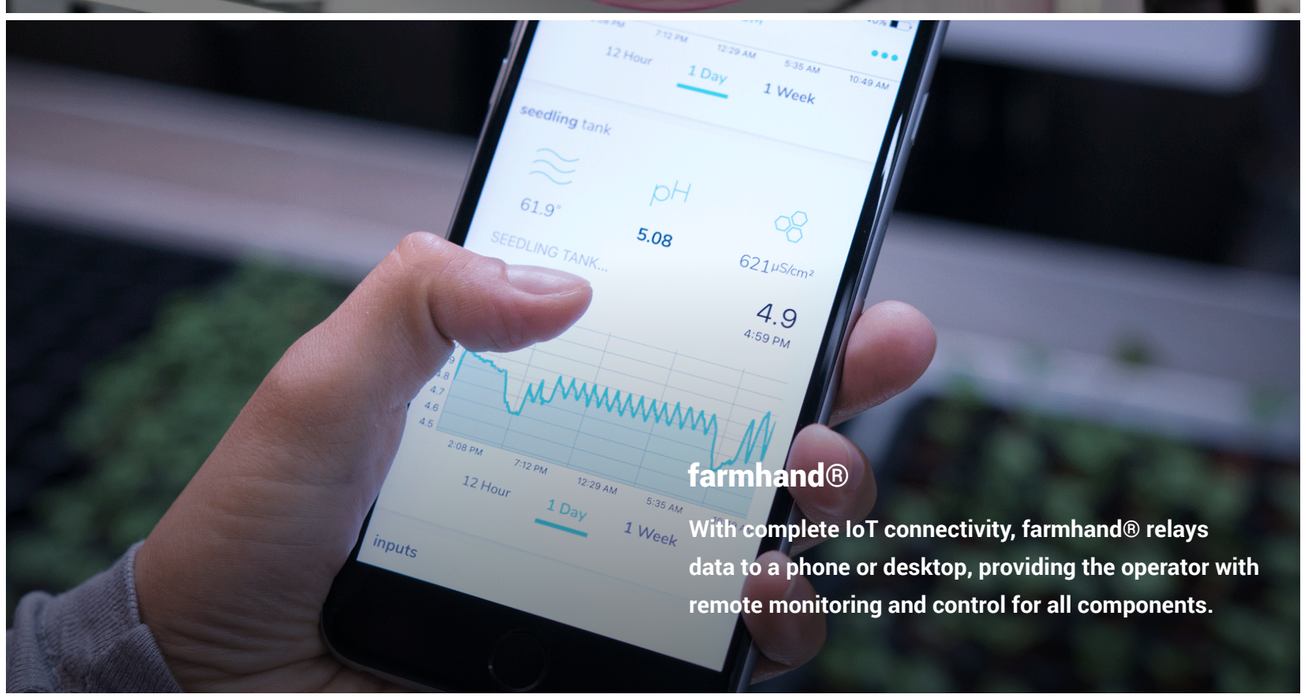

D. E.

BARD Climate Control Unit

Cooling Performance: 3 tons, 36,000 BTU max.
Refrigerant: R-410A
Certifications: AHRI, ETL
Coil Style: Aluminum-finned copper
Cooling Efficiency: 11.0 EER

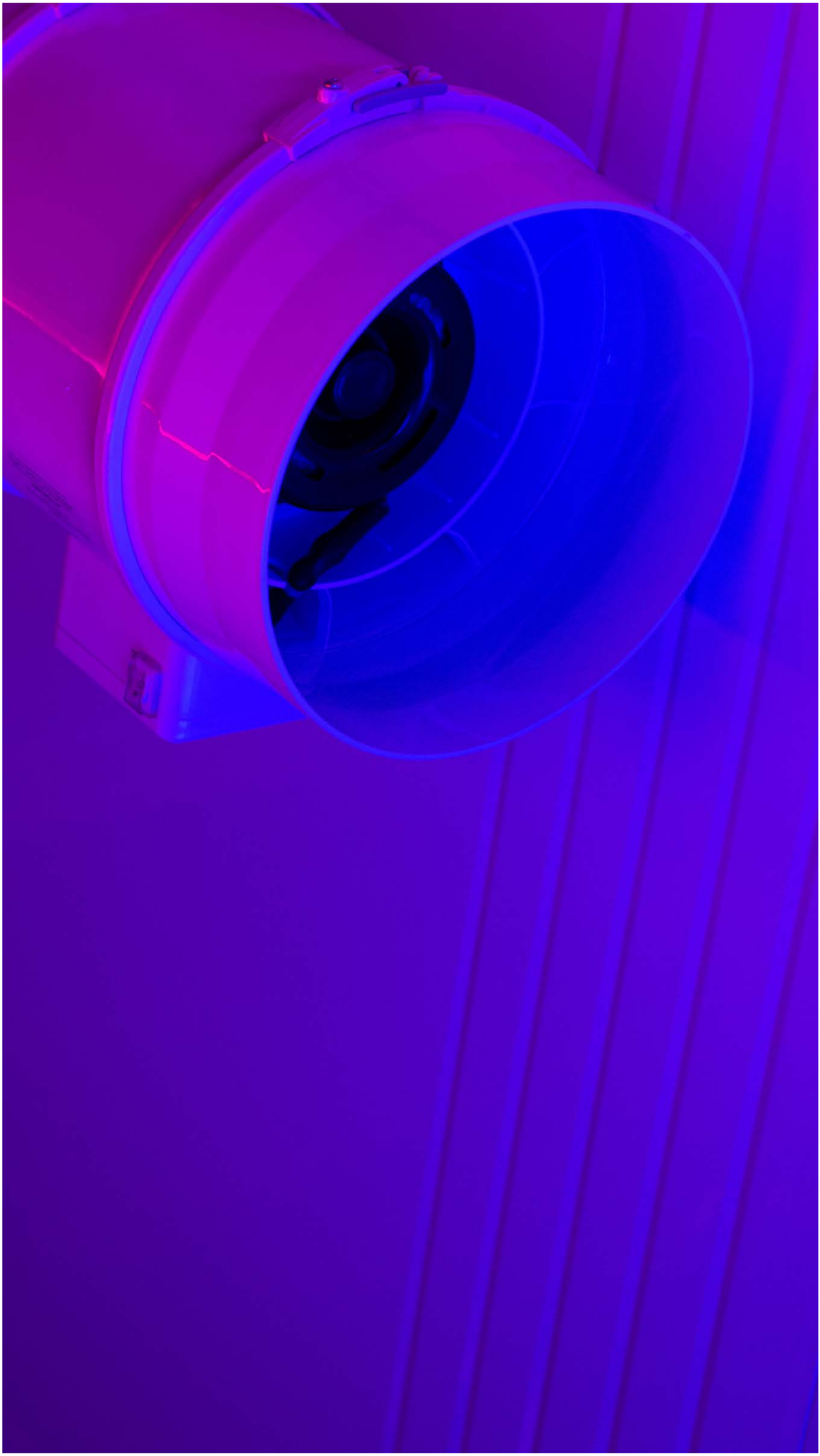
Air Flow

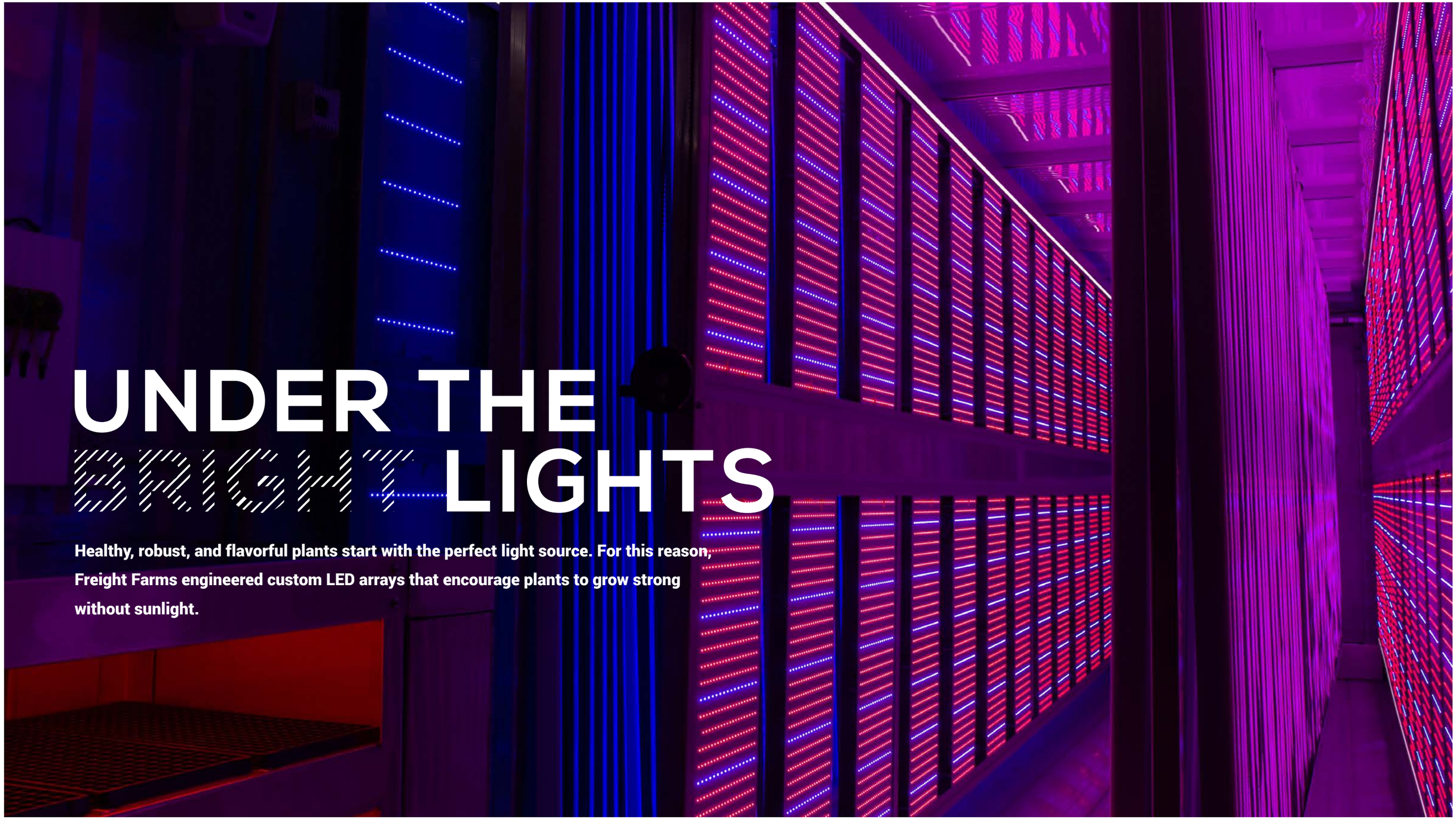
The Greenery's fans stabilize internal temperatures and prevent stale air, which can lead to mold and mildew.



farmhand®

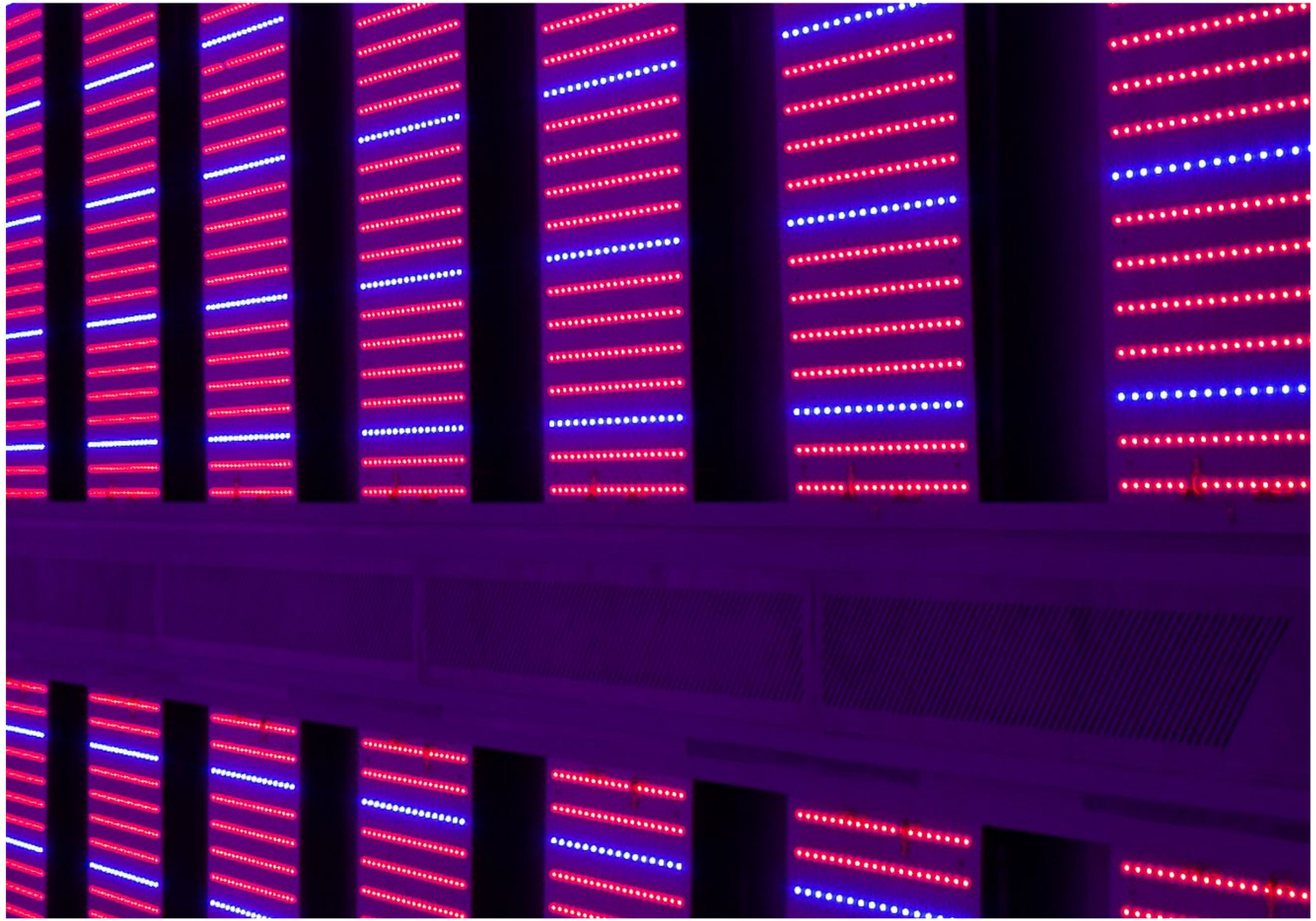
With complete IoT connectivity, farmhand® relays data to a phone or desktop, providing the operator with remote monitoring and control for all components.





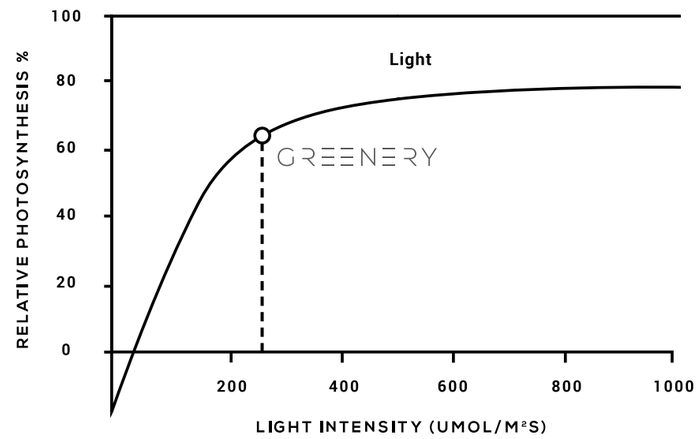
UNDER THE BRIGHT LIGHTS

Healthy, robust, and flavorful plants start with the perfect light source. For this reason, Freight Farms engineered custom LED arrays that encourage plants to grow strong without sunlight.

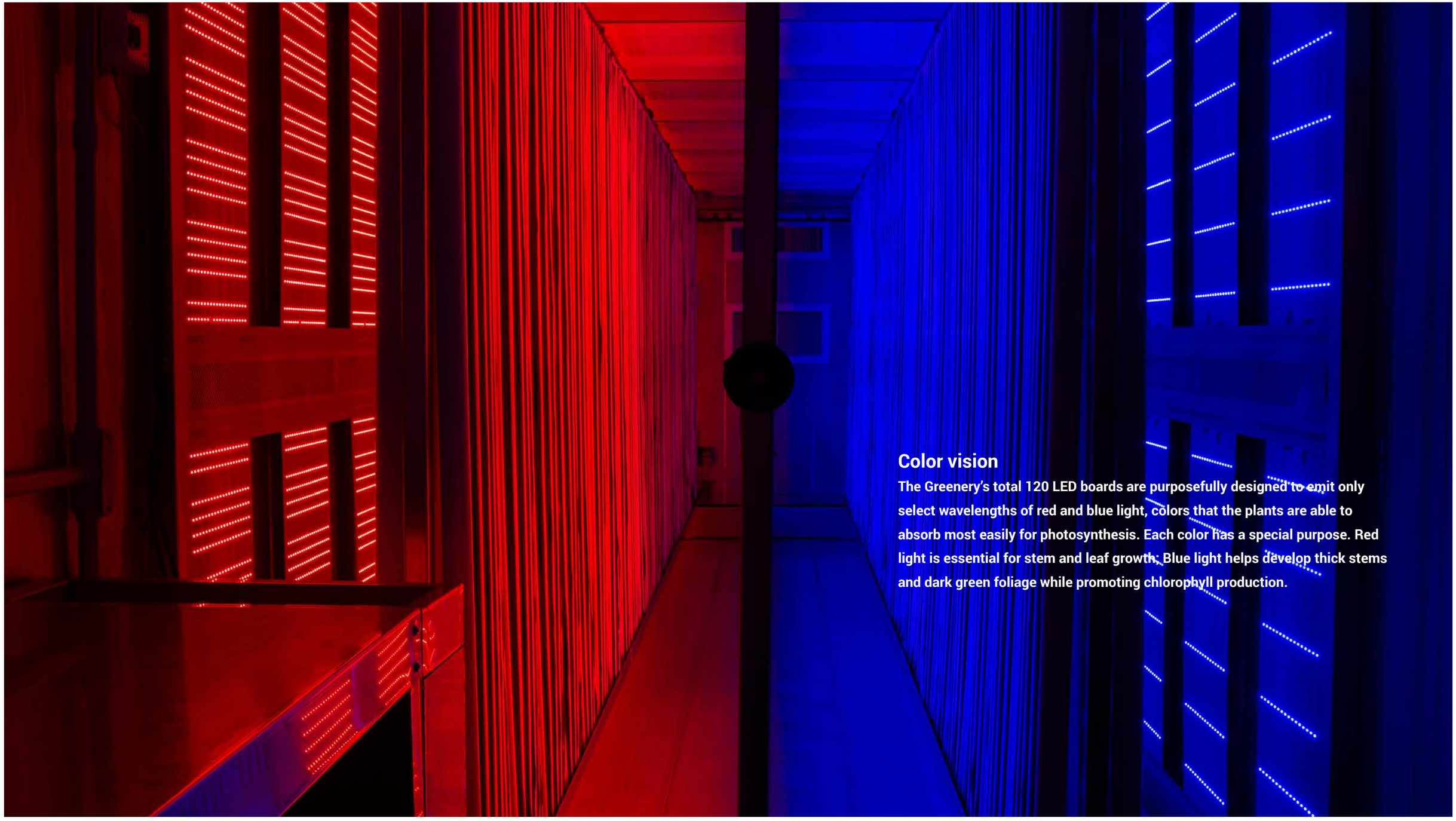


Balance of power

In the cultivation area, the Greenery's LED arrays output an average range of 250 µmol/m²s, meaning plants receive the best quality light at its most efficient point. While more light generally means healthier plants, there are diminishing returns on the rate of photosynthesis after light intensity exceeds a PPFD of approximately 300 µmol/m²s.



The rate of plant growth is directly affected by light intensity (X axis) and the rate of photosynthesis (Y axis). The rate of growth is exponential between 0 and 300 µmol/m²s, but decreases significantly beyond that point because the plant cannot absorb more light even if it is available. Beyond 500 µmol/m²s, light has a minimal effect on the plant's growth.



Color vision

The Greenery's total 120 LED boards are purposefully designed to emit only select wavelengths of red and blue light, colors that the plants are able to absorb most easily for photosynthesis. Each color has a special purpose. Red light is essential for stem and leaf growth; Blue light helps develop thick stems and dark green foliage while promoting chlorophyll production.

Light up the room

Dotted with evenly spaced diodes, the waterproof LED boards are braced by a rigid aluminum frame that focuses light directly onto the crops.

NURSERY STATION LED

8 LED Boards

4 ⅓″ x 43 ⅓″

200 µmol/m²s

Average PPFD

4:1 Red/ Blue Spectrum

660nm red, 450nm blue wavelengths, independent color control.

CULTIVATION AREA LED

112 LED Boards

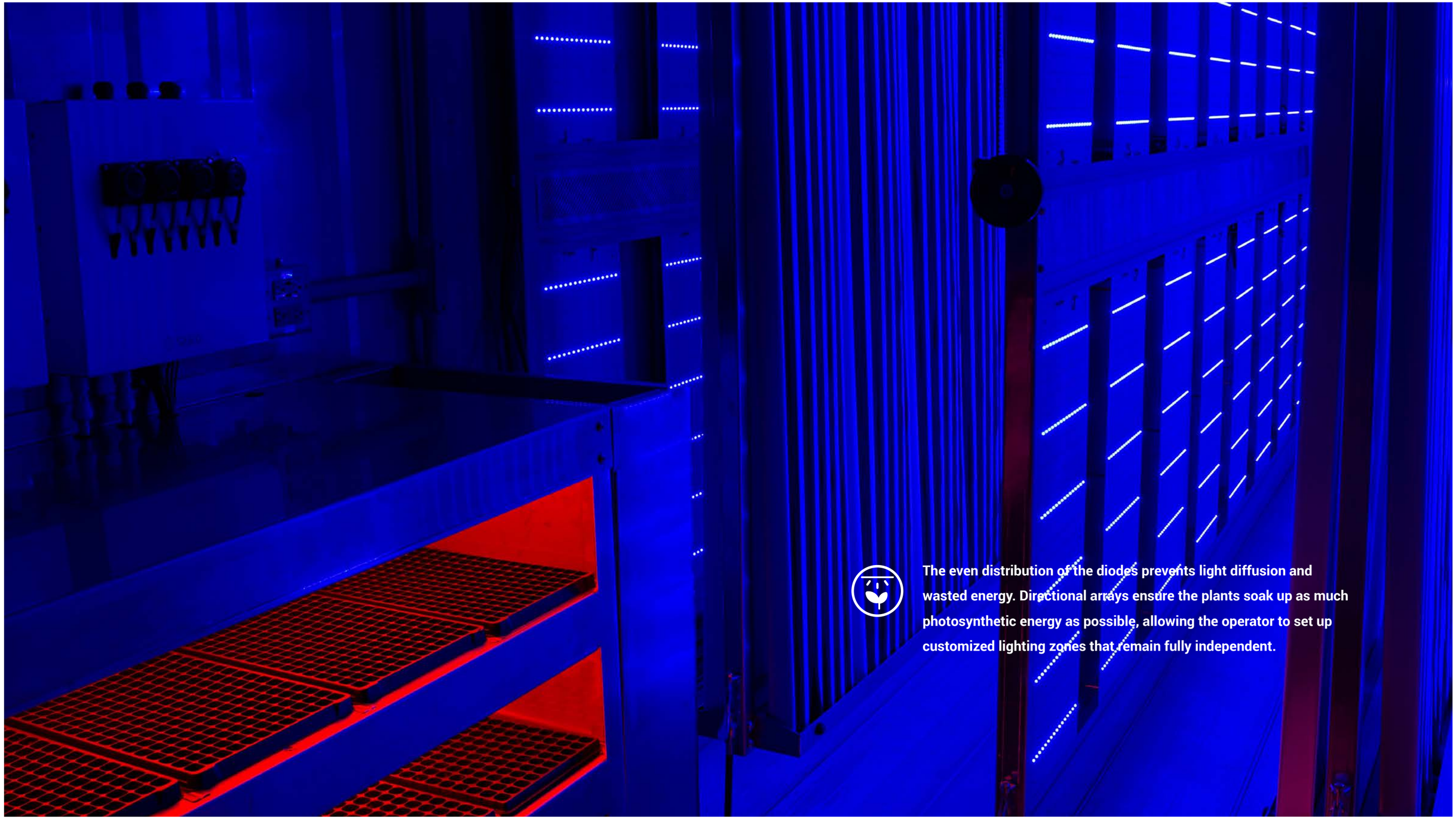
38 ½″ x 13 ¾″

250 µmol/m²s

Average PPFD

5:1 Red/ Blue Spectrum

660nm red, 450nm blue wavelengths, independent color control.



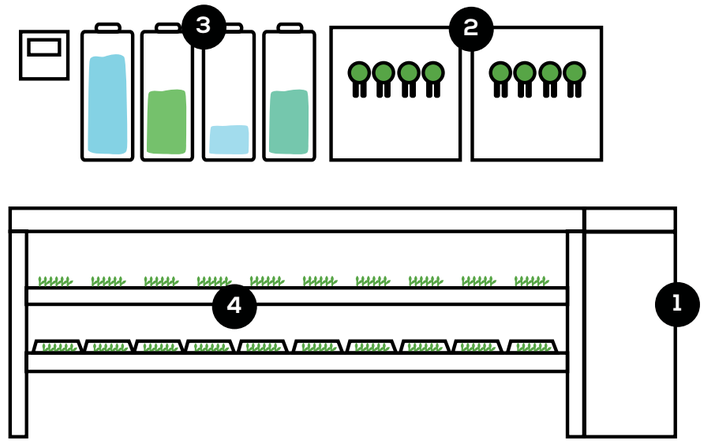
The even distribution of the diodes prevents light diffusion and wasted energy. Directional arrays ensure the plants soak up as much photosynthetic energy as possible, allowing the operator to set up customized lighting zones that remain fully independent.

STATION

The Greenery's seedling nursery is located in the farm's multi-purpose 7.5-foot stainless steel table. Below the worktop, two independently-controlled seedling troughs house up to 4,600 seedlings at once, providing plants with perfect conditions in their first weeks of life.

Ebb & Flow System

A series of sensors and pumps maintain perfect water conditions for the plants germinating in the table's two troughs. Controlled with farmhand®, the cyclical system senses and equalizes nutrient levels, and waters seedlings on a regular schedule.



1. **Nursery Station Tank**
   Water level sensors in the tank communicate to farmhand® when water levels fall below their set point, triggering the tank to auto-fill. An aerator and in-tank air stone oxygenate the water to mix nutrients evenly and prevent algae growth.

2. **Dosing Panels**
   Nutrient, pH, and temperature sensors monitor water conditions and relay data to farmhand®. Peristaltic pumps automatically dose nutrient and pH solutions to maintain levels around predetermined set points.

3. **Nutrient & pH Reservoirs**
   6-qt. refillable reservoirs contain nutrient and pH solutions for the Greenery's seedling and main tanks. The four reservoirs hold nutrient solutions A and B, a pH buffer, and experimental solutions, all of which are available for purchase online at farmhand® Shop.

4. **Seedling Troughs**
   The dual-irrigated, full-width seedling troughs work using ebb and flow irrigation. Water pumps fill the troughs with nutrient-rich water, saturating the seedling roots to help the plants grow. The troughs can be controlled individually, and can multitask as germination, seedling, and microgreen shelves.

The stainless steel work table is the ideal space to manage business operations. Use the space to develop crop schedules, weigh and log harvests, and package crops ahead of distribution.

Nursery Station Features

A. 38-gallon Tank

The nursery station water tank is vertically integrated into the table for easy access. An attachable hose drains water from the nursery tank into the Greenery's main cultivation tank, where it is flows out through a drainage spigot. Conversely, operators can route the hose directly outside through the farm door for straightforward cleaning and maintenance.

B. Specialized LED Array

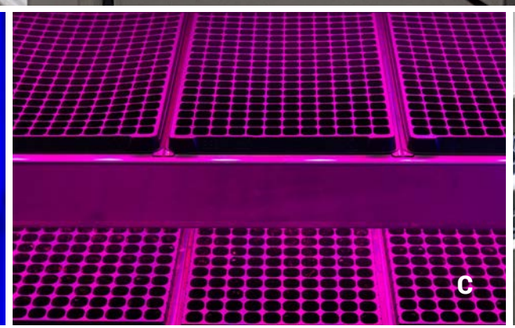
The nursery station features specialized light arrays with a higher ratio of blue lights to encourage strong stem development from the moment seeds sprout.

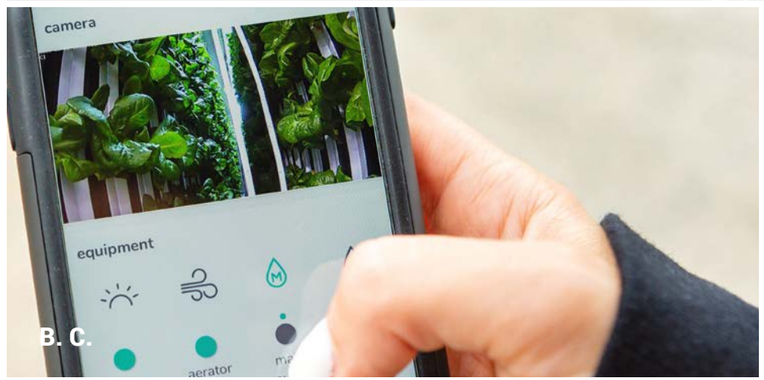
C. Flexible Tray Capacity

The nursery station holds sixteen 200- or 288-cell trays, so that the operator has a constant supply of seedlings. Removable rails make routine trough cleaning effortless.

D. Drainage Basin

The Greenery's drainage basin acts as a designated spot for saturated grow plugs, discarded leaves, and other refuse. The removable catch basin with stainless steel drip tray contains the mess and keeps the work surface sparkling clean.





Digital Farmer Toolbelt

A. Grow Controller

The grow controller is linked directly to farmhand®, compiling and transferring sensor data directly to the app. Additionally, the grow controller functions as an in-farm control panel: operators can turn components on and off as they perform farming, cleaning, or maintenance activities.

B. Camera

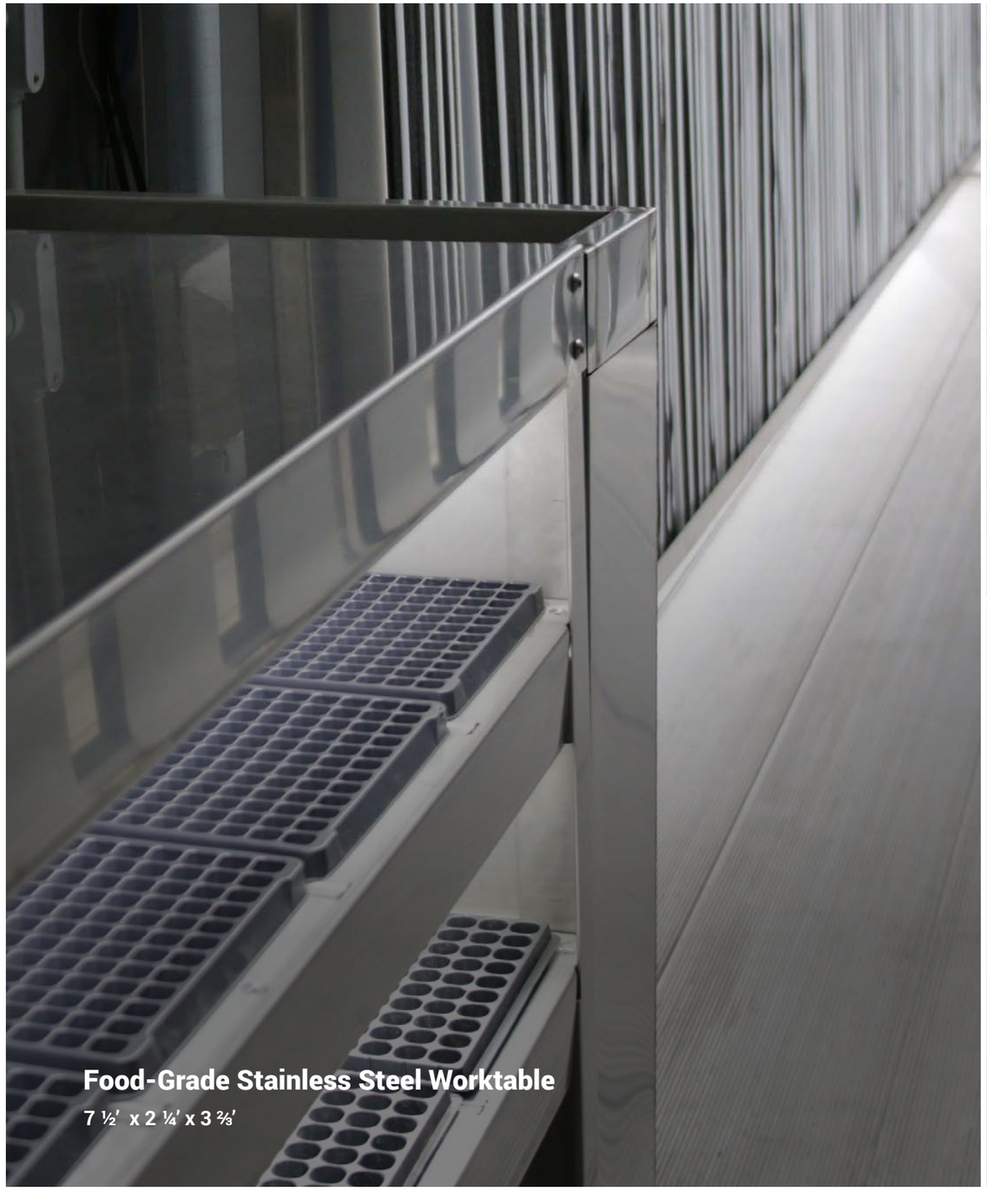
Keep a watchful eye on the Greenery with a farmhand-connected camera. Use the camera for added security, or stitch the photos together to create time-lapses. Easily add additional cameras, available for purchase on farmhand® Shop.

C. Farmhand®

Available for iOS and desktop, farmhand® allows the operator to remotely monitor and control the farm from anywhere in the world, ensuring all of the Greenery's internal components are functioning correctly.

D. Audio Bluetooth Speakers

Create a pleasant work environment with ambient music from the Greenery's two wall-mounted Dayton Audio IO525 premium weatherproof Bluetooth® speakers. By creating small vibrations in the air, music can stimulate plant growth and make the plant cells stronger.

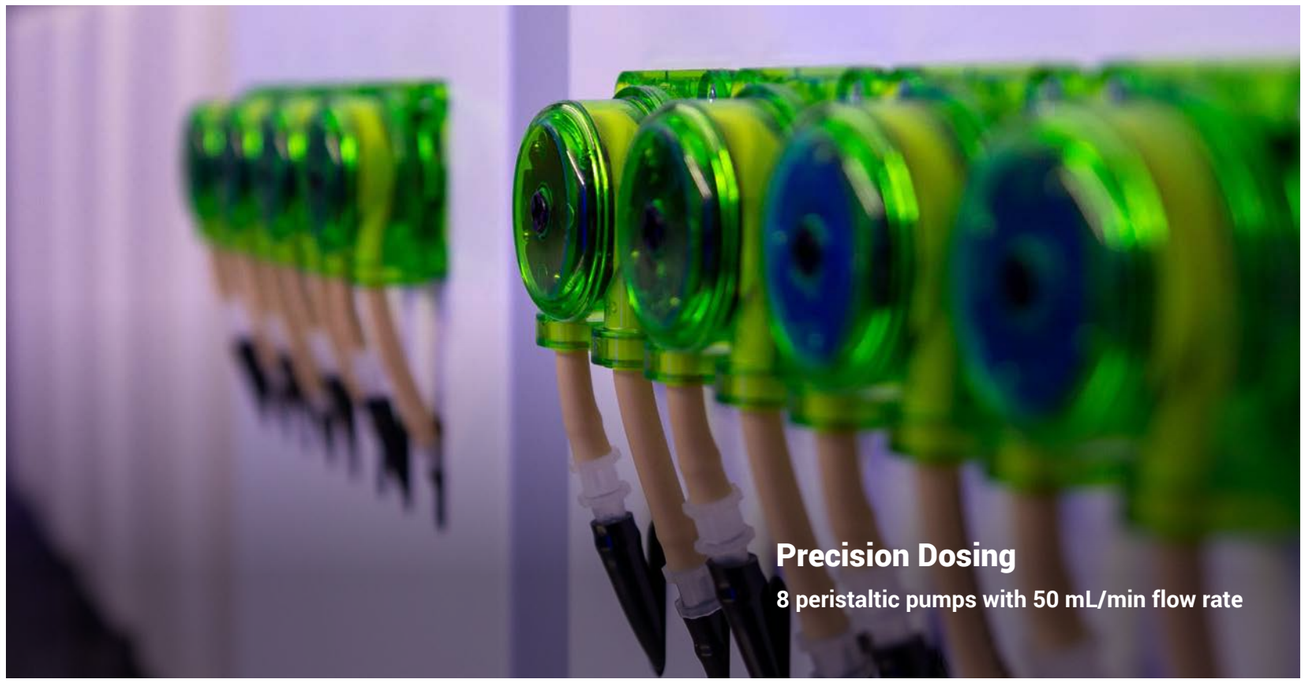


Food-Grade Stainless Steel Worktable

7 ½′ x 2 ¼′ x 3 ⅔′

4,608 Growing Sites

A constant supply of seedlings

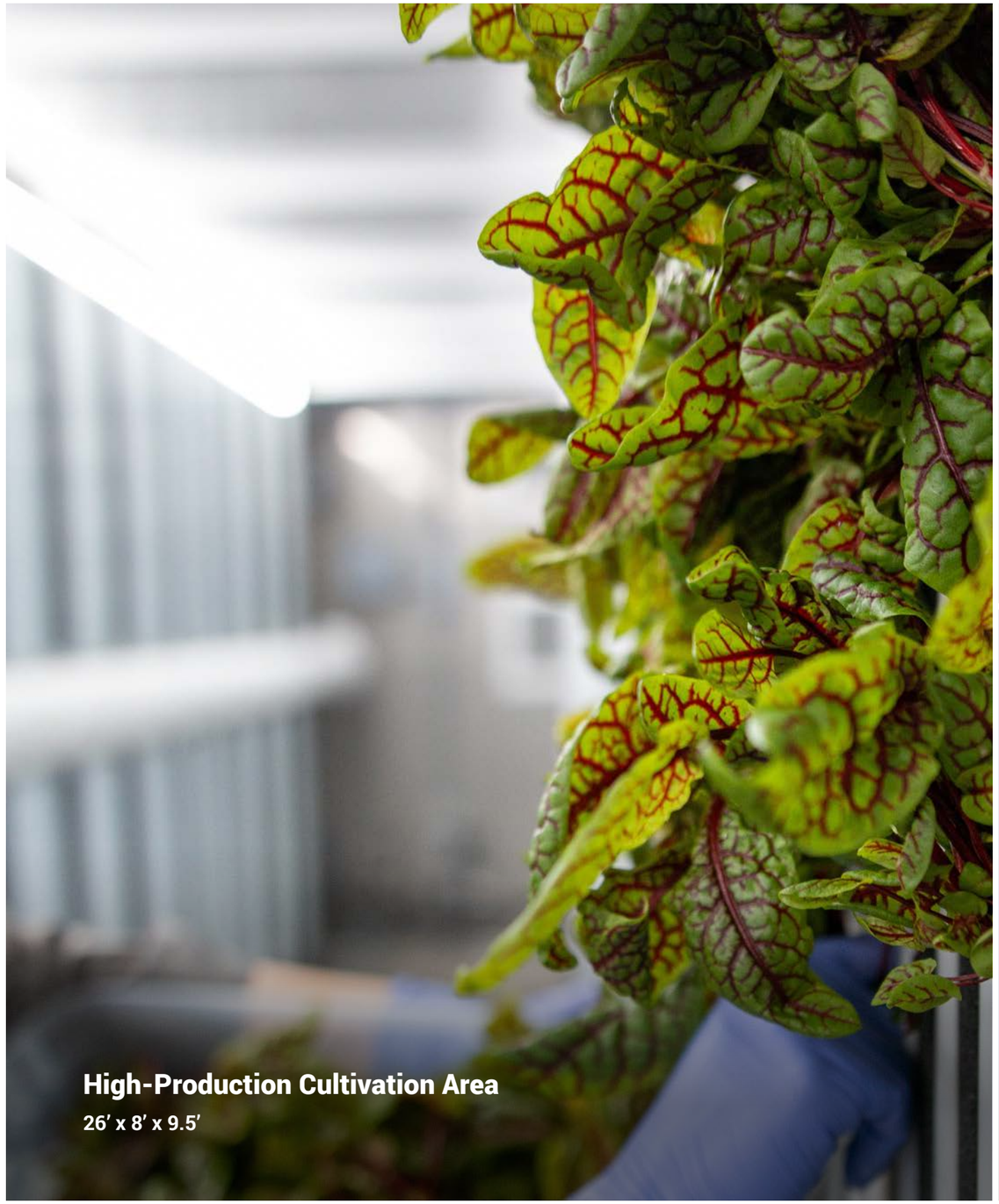


Precision Dosing

8 peristaltic pumps with 50 mL/min flow rate

AREA

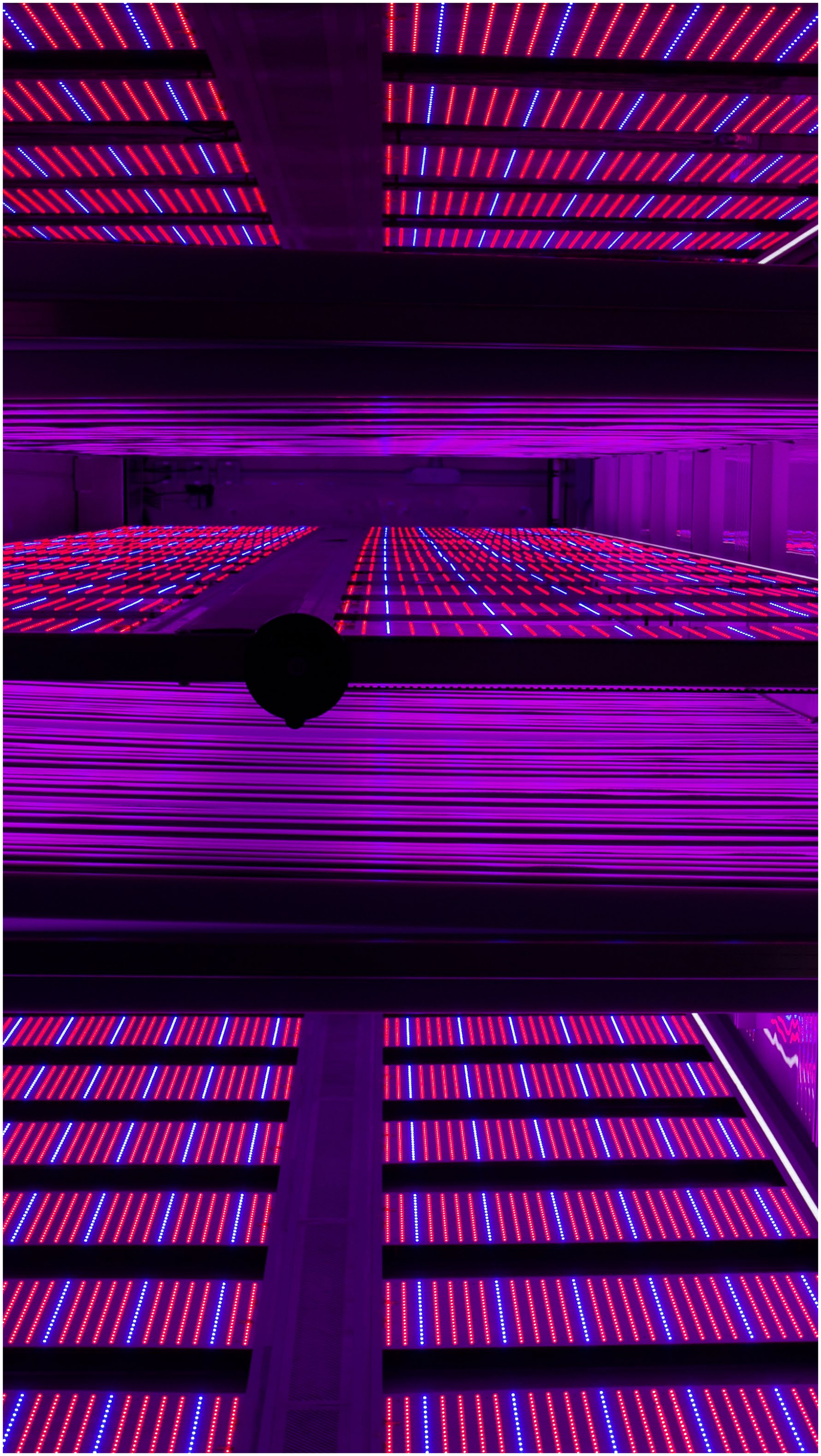
Designed for growing and nourishing large plants, the cultivation area features water-efficient drip irrigation hydroponics, high-capacity plant panels, and an innovative mobile rack system. Combined, these components create a lush 220 square-foot production space.



High-Production Cultivation Area
26′ x 8′ x 9.5′

88 Plant Panels
440 combined growing channels

112 Rigid LED Boards
120° beam angle diodes

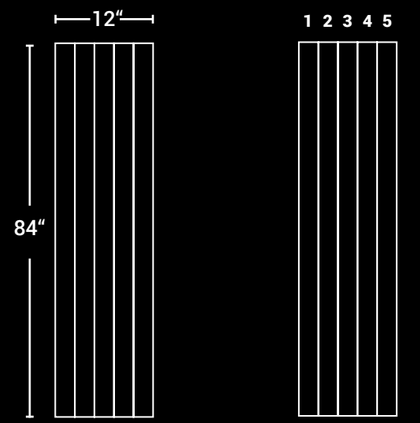


Expert Panel

The Greenery's high-density five-channel plant panels maximize usable space in the farm to unlock new crop possibilities, farming styles, and yield potentials.

The lightweight and sturdy removable panels are shaped from food-safe, high-impact polystyrene. All five channels are paired with a reticulated foam growing medium and an anti-drip wicking strip, which gives plants a structure on which to grow while making sure moisture remains at the root.

PLANT PANEL PROFILE



Plant Panel
Dimensions

5 Channels Per Panel
Up to 100 plant sites

BUILT TO GROW

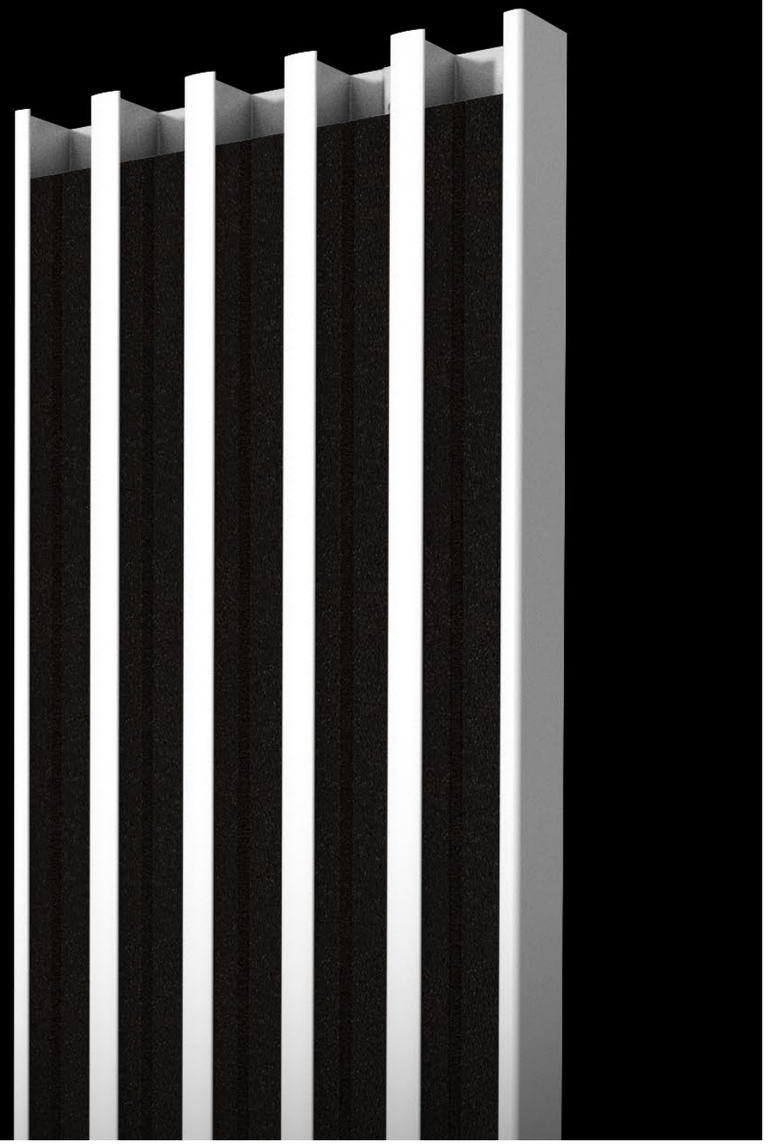
88 Plant Panels
Up to 8,800 plant sites

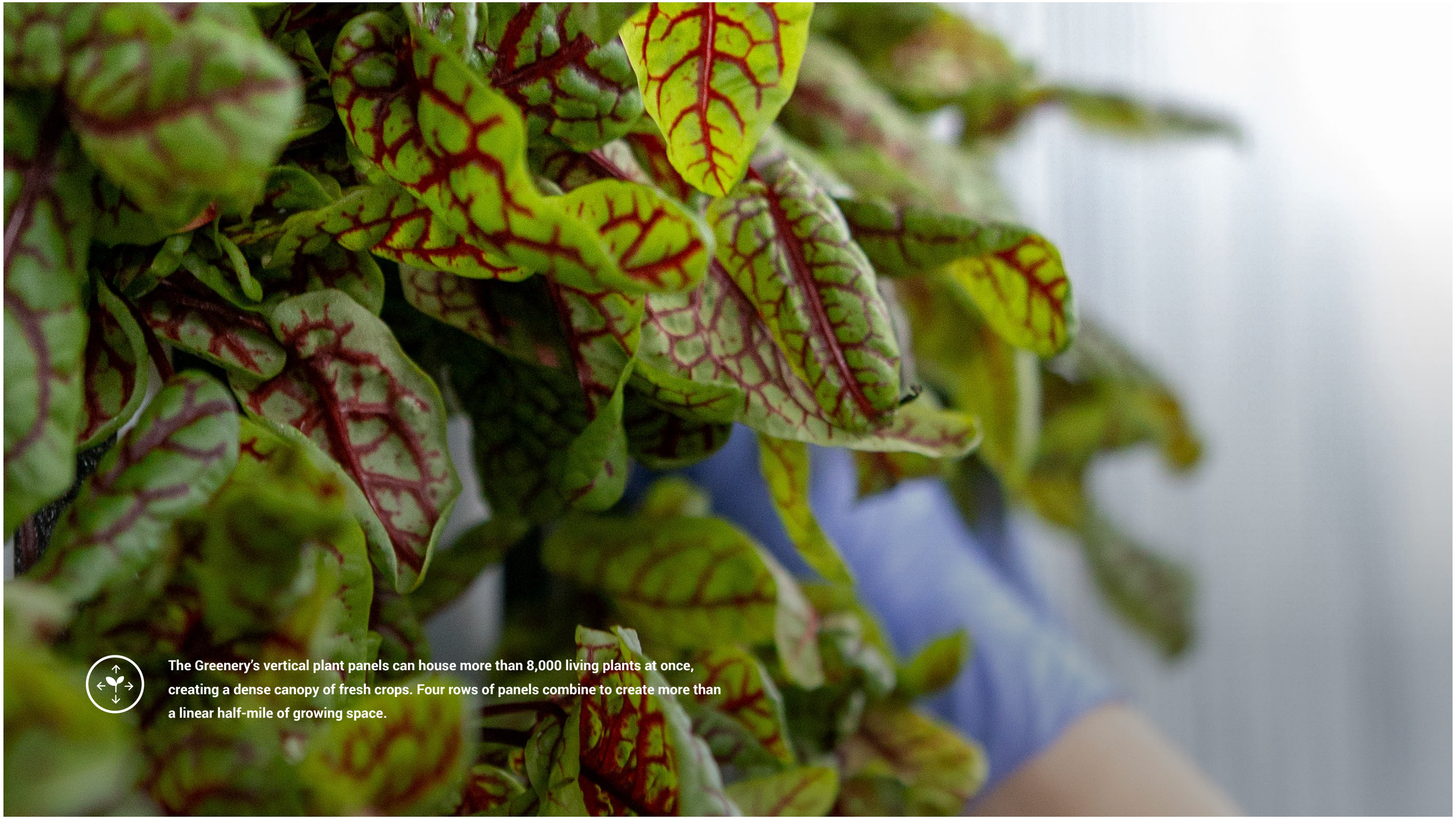
36,960 Inches
Total linear planting space

BUILT FROM

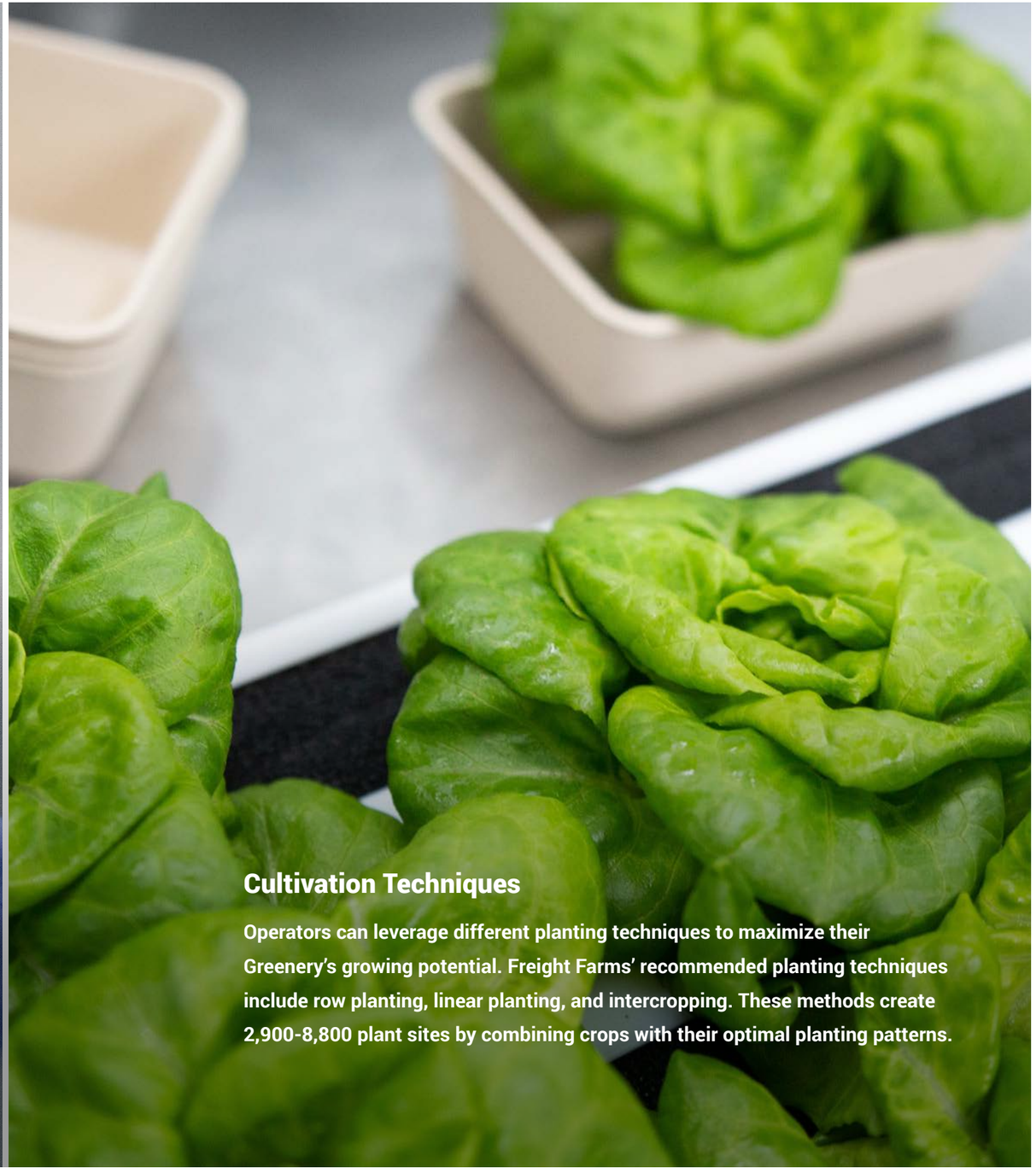
High-Impact Polystyrene
Food safe panel material

Inert Reticulated Foam
Food safe growing medium





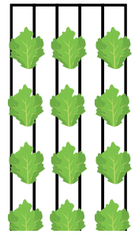
The Greenery's vertical plant panels can house more than 8,000 living plants at once, creating a dense canopy of fresh crops. Four rows of panels combine to create more than a linear half-mile of growing space.



Cultivation Techniques

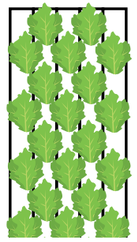
Operators can leverage different planting techniques to maximize their Greenery's growing potential. Freight Farms' recommended planting techniques include row planting, linear planting, and intercropping. These methods create 2,900-8,800 plant sites by combining crops with their optimal planting patterns.

Row planting



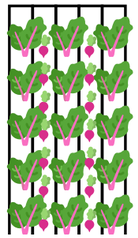
Active channels	1 3 5
Plant sites per channel	**10-15**
Total farm plant sites	**2,600-3,900**
Recommended crops*	**Large crops:** Lettuces, kale, mizuna, Swiss chard

Linear planting

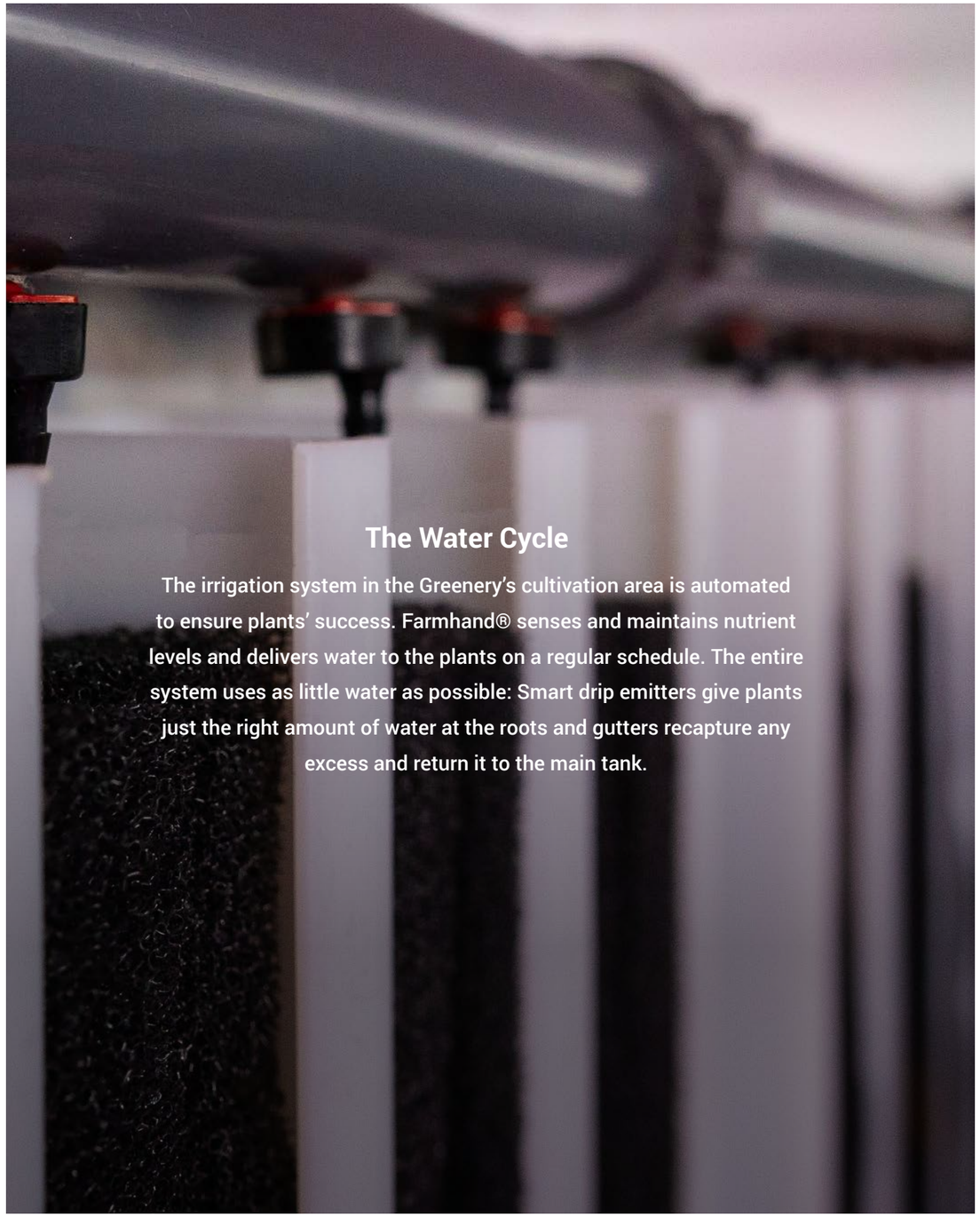


Active channels	1 2 3 4 5
Plant sites per channel	**15-20**
Total farm plant sites	**6,600 - 8,800**
Recommended crops*	**Small trim crops**: Arugula, watercrest, mustard greens **Herbs**: Basil, parsely, cilantro, thyme

Intercropping

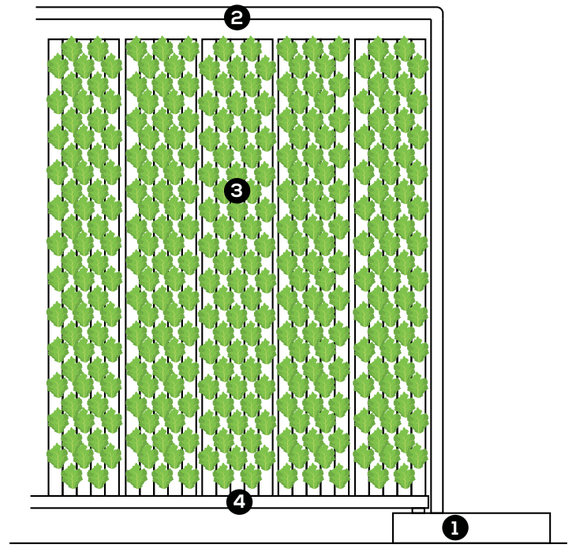


Active channels	1 2 3 4 5
Plant sites per channel	**Large crops:** 10-15 **Small crops:** 17-20
Total farm plant sites	**5,600-7,900**
Recommended pairings*	**Large crops**: Lettuces, kale, mizuna, Swiss chard **+** **Root vegetables**: Radishes, turnips, carrots, beets



The Water Cycle

The irrigation system in the Greenery's cultivation area is automated to ensure plants' success. Farmhand® senses and maintains nutrient levels and delivers water to the plants on a regular schedule. The entire system uses as little water as possible: Smart drip emitters give plants just the right amount of water at the roots and gutters recapture any excess and return it to the main tank.

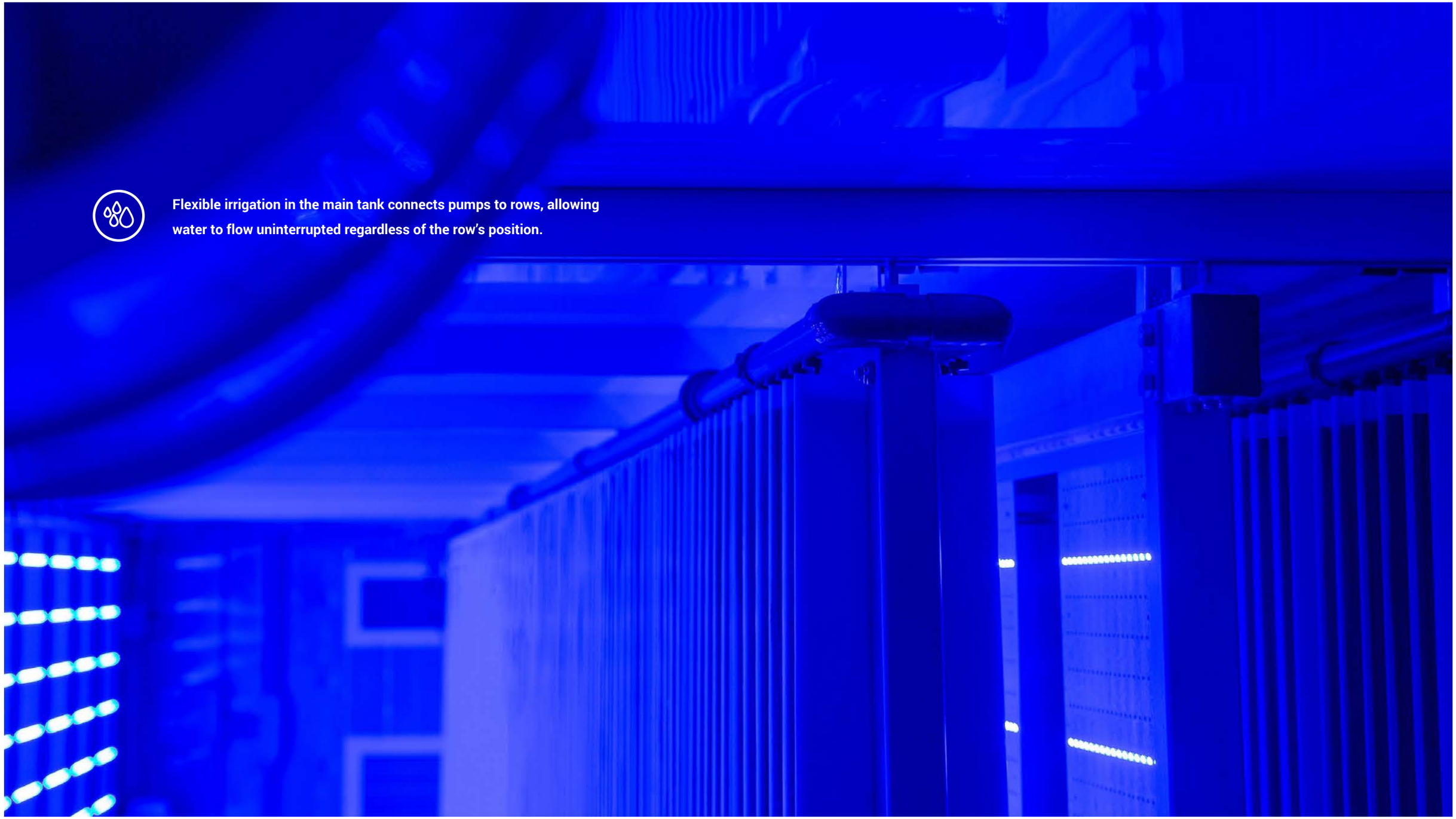


1. **Cultivation Area Tank**
   The 110-gallon tank supplies nutrient-rich water to the entire irrigation system. Farmhand® automatically monitors and manages the water's nutrient concentration and pH balance.

2. **Gravity-Assisted Drip Irrigation**
   Pumps send nutrient-rich water from the cultivation tank to overhead plumbing at regular intervals based on a pre-set watering schedule. 440 pressure-regulating emitters control the water flow at a continuous drip, as water travels towards the ground at a rate of 2 gallons/hour.

3. **Plant Panel**
   Reticulated foam nestled in rigid plant channels holds crops in place as gravity pulls water down the cloth wicking strip along the length of the plant panel, giving the roots direct access to water.

4. **Gutters**
   Recirculation gutters move with each row and drain unused water back into the main tank, where pH and nutrients are rebalanced and the water is recycled.



Flexible irrigation in the main tank connects pumps to rows, allowing water to flow uninterrupted regardless of the row's position.

Cultivation Area Features

A. 110-Gallon Tank

The main cultivation tank is situated along the floor at the rear of the Greenery. Sensors inside the tank provide automatic water-level management by triggering smart valves to open and refill water to the proper level. Five aerator tubes and corresponding air stones constantly oxygenate the water and mix nutrients evenly throughout.

B. Work Lights

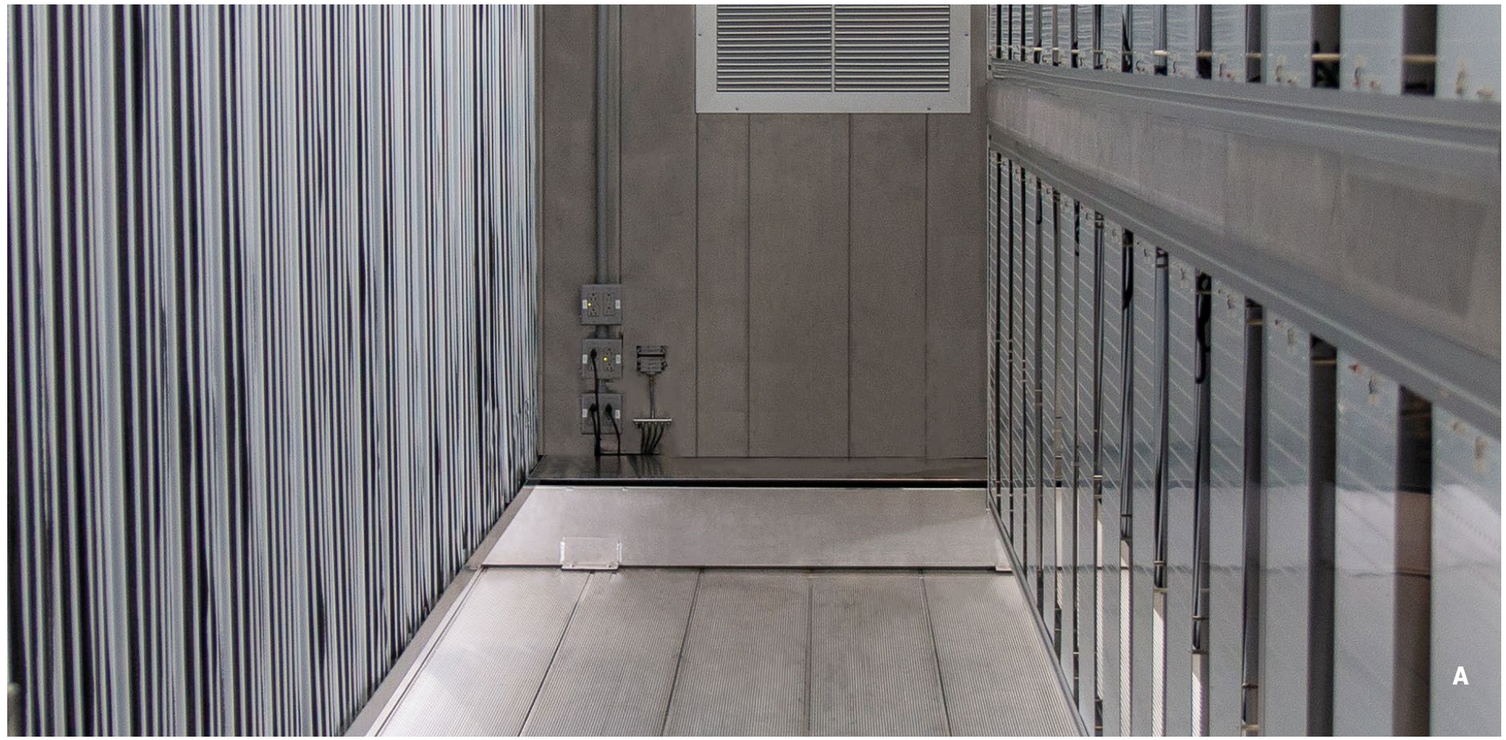
LED work lights run along the top and bottom of the rows, illuminating the space for operators as they work in the farm. The work lights emit a white light that is simultaneously gentle on the eyes and bright enough for in-depth cleaning and plant care.

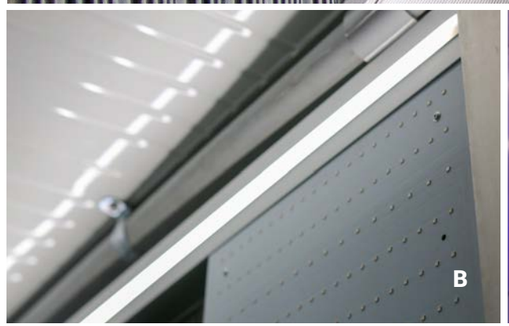
C. Removable Ducting

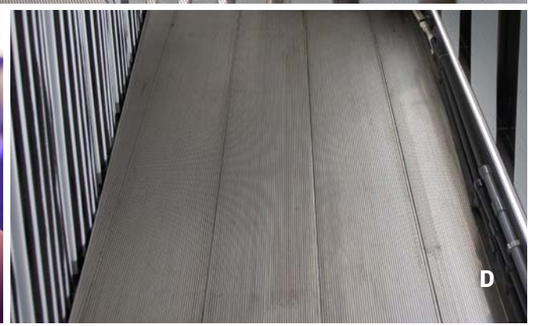
On-panel ducting made of antimicrobial flexible polyester ensures consistent airflow in the dense growing environment. Unhook the VELCRO® fastening to move ducting during cleaning, or remove entirely to launder the machine-washable fabric.

D. Easy-to-Clean Surfaces

The Greenery is a clean, food-safe environment with aluminum and stainless steel surfaces that are easy to wipe down, including a lightly grooved floor that is convenient to sweep or vacuum.

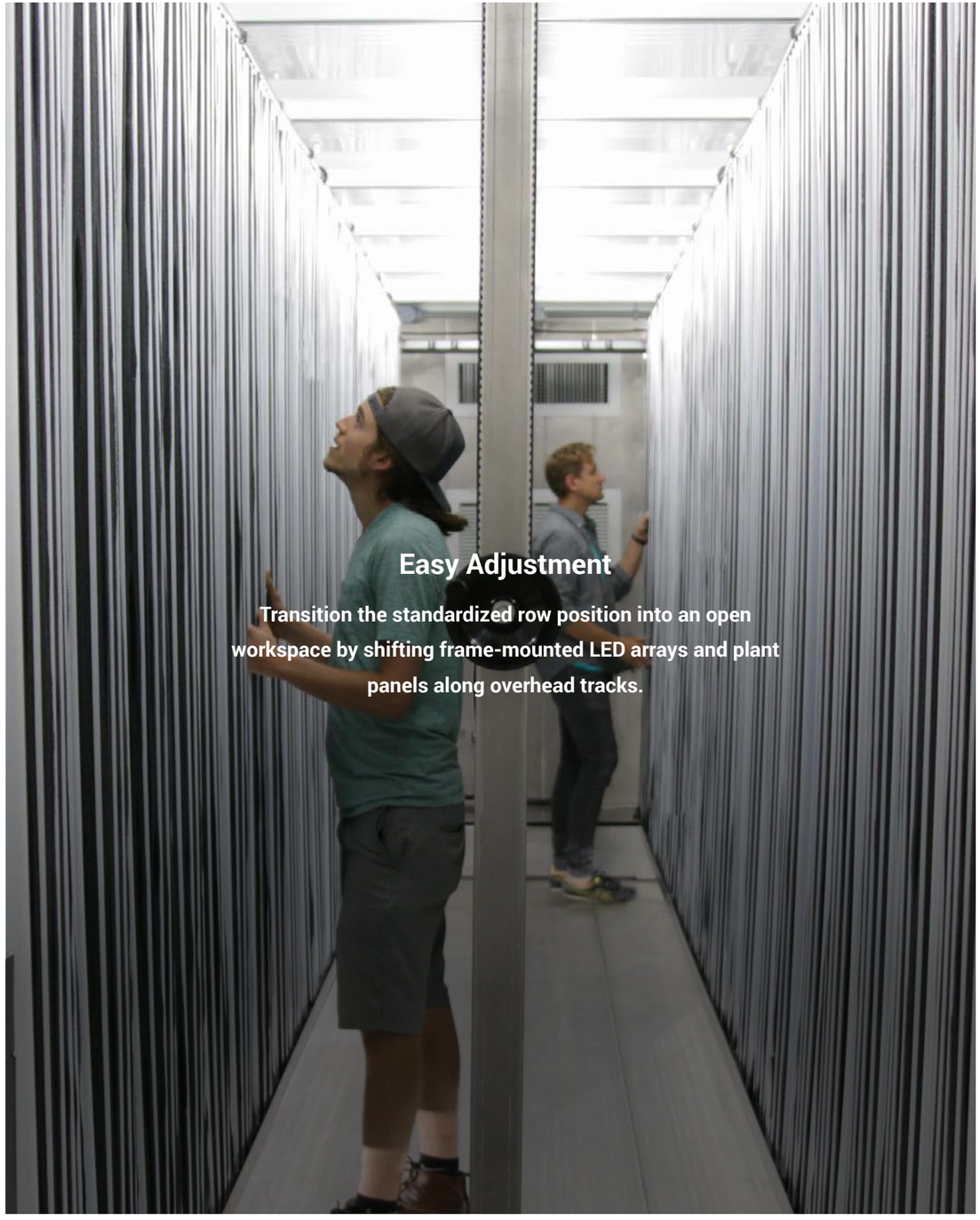






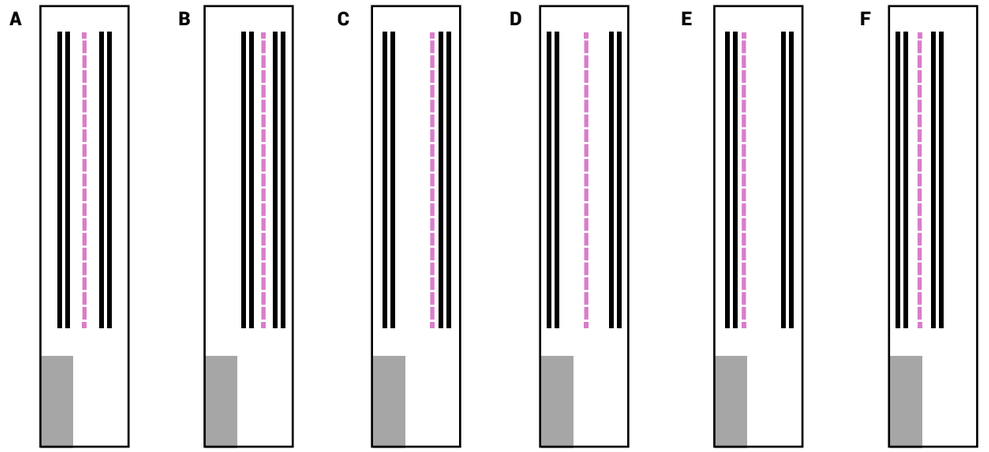
RIGHT ON TRACK

The Greenery's best space-optimizing feature is its flexible cultivation area. The entire system—plant panels, light arrays, plumbing, and all—move laterally along aluminum overhead tracks, allowing the operator to transition the farm from a high density growing environment to an airy workspace at will.



Easy Adjustment

Transition the standardized row position into an open workspace by shifting frame-mounted LED arrays and plant panels along overhead tracks.

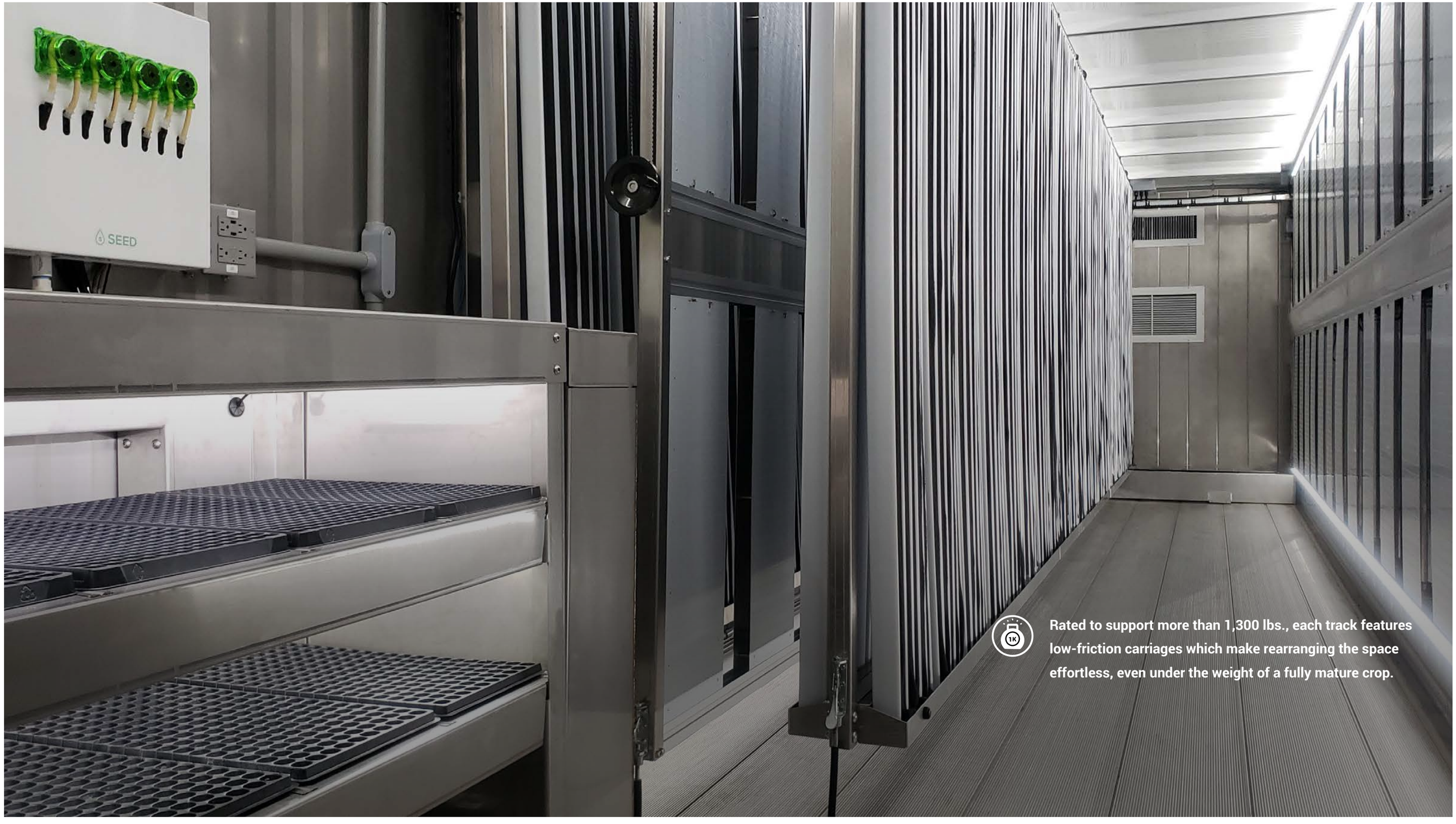


A. **Standard Growing Position**

For the majority of the time, the Greenery's racks remain in four evenly-spaced rows, with plant panels and LED arrays separated by 18 inches. Visual guides help operators reposition back to this default spacing.

B - F. **Customizable Spacing**

Row widths can be easily adjusted to allow for in-row transplanting, harvesting, cleaning, and maintenance. Additionally, row widths can be shifted and fixed to meet the spacing needs of different plant varieties. For example, herbs grow small and close together, while vining crops need room to expand. The Greenery is able to accommodate both simultaneously.



Rated to support more than 1,300 lbs., each track features low-friction carriages which make rearranging the space effortless, even under the weight of a fully mature crop.

Row Mobility Features

A. Frames

Supporting the plant panels and middle LED arrays, the Greenery's aluminum frames run the length of the Greenery.

B. Tracks

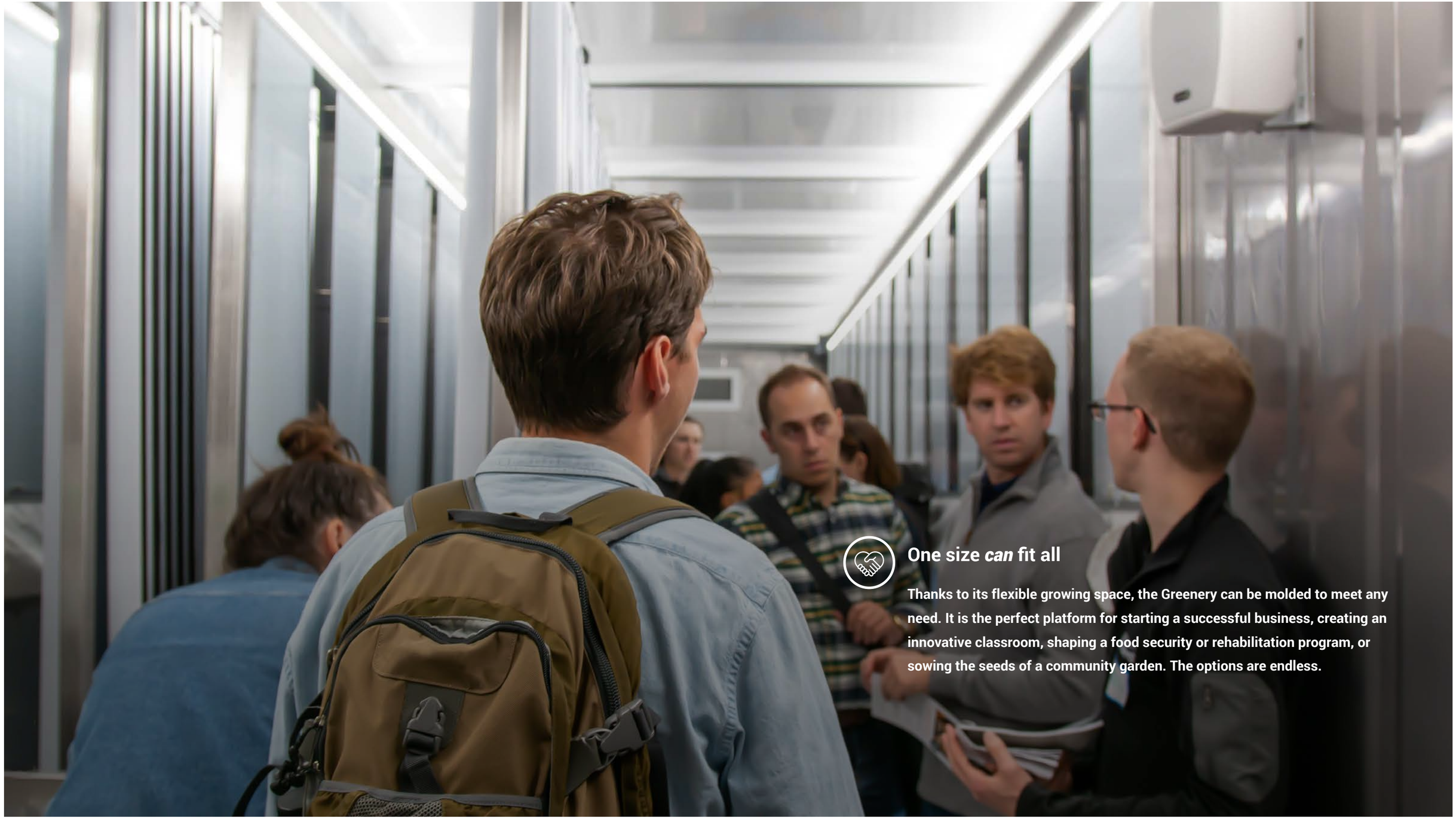
Eight anodized aluminum tracks are set perpendicular to the Greenery's frames and are the structures that allow the frames to be shifted laterally to create more direct plant access or custom row spacing. Overhead rubber stoppers prevent frames from colliding during adjustment.

C. Carriages

A total of 24 carriages connect the Greenery's frames to the overhead tracks. The carriages work in conjunction with the rack and pinion system to adjust row widths. Made of anodized aluminum and steel with rubber-coated wheels, the carriages glide noiselessly.

D. Rack and Pinion System

The spacing between each row is controlled with a simple rack and pinion system. A hand wheel on the front of each moveable row attaches to a pulley, which spins a shaft to move the pinion along two rack gears–one at the front, one in the rear. In addition to moving the rows, the system also holds the rows in place.



One size *can* fit all

Thanks to its flexible growing space, the Greenery can be molded to meet any need. It is the perfect platform for starting a successful business, creating an innovative classroom, shaping a food security or rehabilitation program, or sowing the seeds of a community garden. The options are endless.

ANYTHING UNDER THE SUN

The Greenery's ultimate purpose is to grow food in the most unlikely of circumstances. The powerful lights, precise climate control, and a constant supply of nutrient-rich water allow operators to achieve this mandate and bring fresh produce directly to their communities.

Hundreds of Varieties

The Greenery can produce over 500 types of lettuces, herbs, leafy greens, and small root vegetables at a commercial scale. Operators are also able to grow fruiting and vine plants, such as berries, small peppers, tomatoes, and more–a capability not often feasible in other vertical farm systems.

Recipes for Success

Greenery operators can grow unique, flavorful, and high quality plants using standardized Freight Farms 'recipes'—combinations of light and water schedules with temperature, pH, CO_2, and nutrient levels that create perfect growing environments for a variety of crops, all controlled with the farmhand® app.

Specialty Crops
Grow uncommon and non-native crops that are difficult to find in the standard marketplace.

Flavor Profile
Finely-tune the inside environment to boost plant's natural flavor characteristics.

Consistent Production
Untether crops from their typical growing season and grow a consistent quality and quantity year-round in the protected indoor environment.

Understanding the phases of plant development is the key to a successful harvest. The four main stages for leafy green plant growth are seed, sprout, seedling, and mature plant. As the operator, these stages translate into three process steps: seeding, transplanting, and harvesting.

The Whole Life Cycle

Seeding

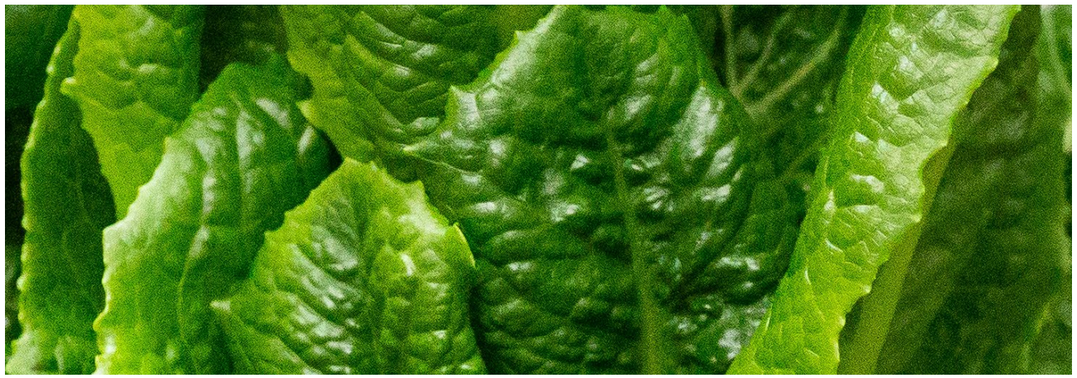
The plant's life cycle begins when seeds are planted in peat moss grow plugs. The peat-moss itself does not provide the seed with nutrients. Instead, the pH-balanced plug acts as a sponge for absorbing nutrient-rich water and–as the seedling matures–containing and supporting the plant's developing root structure.

Germination

To activate germination, the seeds and plugs require a one-time soak in nutrient-rich water, after which they are covered with a humidity dome and left to grow. After a week, the seeds become sprouts, characterized by small roots, short stems, and a few immature leaves.

Seedling Growth

Over two weeks, the sprouts develop into seedlings–taller, sturdier plants with a secure root system. During this time, seedlings need consistent access to water and light: The young plants are automatically given nutrient-rich water and direct light based on farmhand® programming to develop strong stems that support the plant's weight later in its life cycle.



Transplanting

Seedlings are transplanted into the main cultivation area where they grow vertically for the first time. The roots (still in the peat-moss grow plug) are wedged into the the plant panel's stiff foam, which provides firm support and access to nutrient-rich water. The plants face outwards towards the LED arrays, exposing the leaves to the strong directional light and encouraging them to grow.

Leaf Development & Harvesting

Based on the desired size and weight at harvest, plants spend 2-5 weeks in the Greenery's cultivation area. During this time, leaves acquire their rich green, purple, or red color and identifying flavor. When the time comes, the plants can be harvested (removing the entire plant, including roots) or trimmed (cutting mature leaves while the roots and small leaves remain).

Flowering & Fruiting

All plants have a vegetative phase, at which point many are harvested. However, other plants can continue to grow and develop flowers and even 'fruit' (this can be fruit, vegetables, or berries). Flowering and fruiting crops can be grown in conjunction with greens using hand-pollination techniques, or the Greenery operator can focus solely on flower and fruit production by switching to specialized nutrients that maximize outputs.

REQUIREMENTS

The Greenery has only a handful of simple requirements to get started: a designated site, access to water and electricity, internet connection, and basic growing supplies.

GREENERY OPERATIONS & SITE PREPARATION

Site

Place the Greenery on a flat, unobstructed plot measuring 50’x10’. The site surface must support the Greenery’s 8-ton gross weight. Asphalt, trap rock, railroad ties, sonotubes, or a concrete pad are all adequate.

Site Dimensions

Farm Site Length	50 Feet	1524 Centimeters
Farm Site Width	10 Feet	305 Centimeters
Farm Site Height	9.7 Feet	296 Centimeters

Electricity

The Greenery requires a 100 amp, 120 volt split-phase connection (120/208 volt three phase is also acceptable.)

Water

The Greenery uses an average of 5 gallons of water a day. The site should have water access within 50 feet; alternatively, operators can schedule regular water deliveries.

Supplies

Operators can source their supplies from any vendor or conveniently replenish them via farmhand® Shop. Everyday consumables include peat moss plugs, seeds, nutrient solutions, and cleaning supplies.

WIFI

A WiFi signal is necessary for farmhand® connectivity.Farmhand® will use about 1 GB per month per farm.

Farm Delivery

Compared to a traditional farm or warehouse grow operation, the Greenery's modular design makes it easy to transport anywhere in the world via truck, train, or boat. Freight Farms works with operators to schedule all delivery logistics.

GREENERY SPECIFICATIONS

Container & Climate

Container	
Dimensions	40′ x 8′ x 9.5′
Insulation	R-28 Department of Energy Insulation Rating
BARD Climate Control Unit	
Air Conditioner	3 ton 36,000 BTU Max. Packaged unit with integrated dehumidifier & economizer
Economizer Air Intake	1,100 CFM
Moisture Reclamation	1.88 gal. / hour at 75ºF, 65% relative humidity
A/C Efficiency Rating	11.0 EER
A/C Refrigerant	R-410A
A/C Certifications	AHRI, ETL
A/C Coil Style	Aluminum-finned copper
Fans	
Exhaust Air Speed	141 CFM
Air Exchange Rate	Up to 6 exchanges/hour
Overhead Fan Ventilation	880 CFM
Ducted Fans Ventilation	473 CFM
Ducted Fans Diameter	8 in.
CO_2 Regulator	
Regulator	Precision Regulator with Heavy-Duty Solenoid Valve

LEDs

Overview	
Red LED Photosynthetic Wavelength	660nm
Blue LED Photosynthetic Wavelength	450nm
LED Board Waterproof Rating	IP65
LED Diode Blended Efficiency	2.7 µmol/joule
Nursery Station	
Number of LED Boards	8
LED Boards Dimensions	4.3 in x 43.3 in
LED Array Intensity	200 µmol/m^2s average
LED Array Ratio	4:1 red / blue
LED Wattage	164W per trough, 328W per station
Cultivation Area	
Number of LED boards	112
Number of LED Arrays	4
LED Boards Dimensions	38.5 in x 13.75 in
LED Array Intensity	250 µmol/m^2s average
LED Array Ratio	5:1 red / blue
LED Wattage	4060W per array, 8120W total

Worktable & Nursery Station

Nursery Station	
Seedling Capacity	Up to 4,608
Seedling Tray Capacity	16 200 or 288-cell trays
Number of Seedling Troughs	Two full-width seedling troughs
Worktable	
Table Dimensions	90 in x 27 in x 43 in
Table Construction	TIG-welded stainless steel

Hydroponics

Irrigation	
Circulation Pump Filtration	6 Nylon Monofilament Meshes
Aeration System	793 gal. / hr. fluid oxygenator
Mesh Rating	75 micron
Number of Peristaltic Dosing Pumps	8
Peristaltic Dosing Pumps Flow Rate	50 mL/min
Nursery Station	
Hydroponic System	Ebb and flow configuration
Seedling Tank Capacity	38 gal.
Cultivation Area	
Hydroponic System	Overhead drip configuration
Main Tank Capacity	110 gal.
Plumbing	NSF61 PVC
Drip Emitters	Self-flushing, clog-resistant
Drip Emitter Flow Rate	2 gallons/hour

GREENERY SPECIFICATIONS

Plant Panels & Adjustable Rows

Plant Panel	
Plant Panel Design	5-channel
Plant Panel Construction	High impact polystyrene
Plant Panel Growing Medium	Inert reticulated foam
Total Number of Panels	88
Total Number of Channels	440
Combined Linear Growing Space	36,960 in/ 3,080 ft/ 3.6 acres

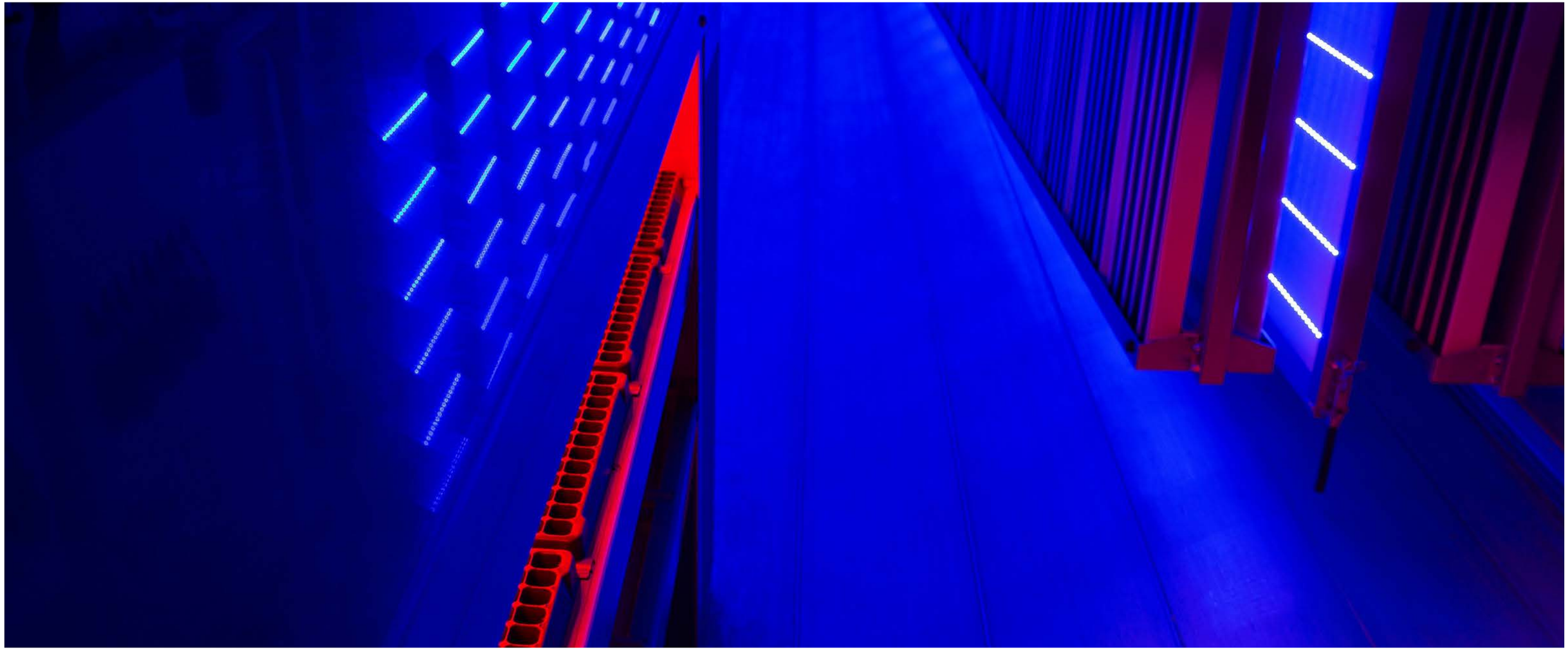
Adjustable Rows	
Number of Grow Rows	4
Adjustment System	Rack and pinion
Rack System Load-bearing Capacity	1,300 lbs max.
Number of Frames	3
Frame Construction	Aluminum
Track Construction	Anodized aluminum
Carriage Construction	Anodized aluminum, rubber-coated wheels

Tech

Grow Controller	
Number of Controlled Outputs	32
Number of Spare Outputs	1
Number of Controlled Inputs	8
Number of Spare Inputs	6
Zones & Sensors	2 Hydro zones (pH, EC, and temperature sensors) 1 Climate zone (Temp, RH%, CO_2) 2 Water level sensors (Nursery Station Tank, Cultivation Area Tank)

farmhand®-Connected Camera	
Number of Cameras	1 Amcrest ProHD Shield Wireless IP Security Camera
Camera Data Storage	MicroSD and Cloud Storage
Camera Resolution	960P 1.3 Megapixel (1280*960P) 140° Viewing Angle Digital Zoom & Night Vision

Bluetooth® Speakers	
Number of Speakers	2 Dayton Audio IO525 Speakers
Speaker Connection	Bluetooth®-connected
Speaker Construction	Weather resistant ABS plastic enclosure and aluminum grills Polypropylene 5-1/4” woofer Metalized Mylar 1” dome tweeter



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freightfarms.com

44 Plympton St.
Boston, Massachusetts 02118