



GRENERY

GREEN • HOUSE

NURS • ERY

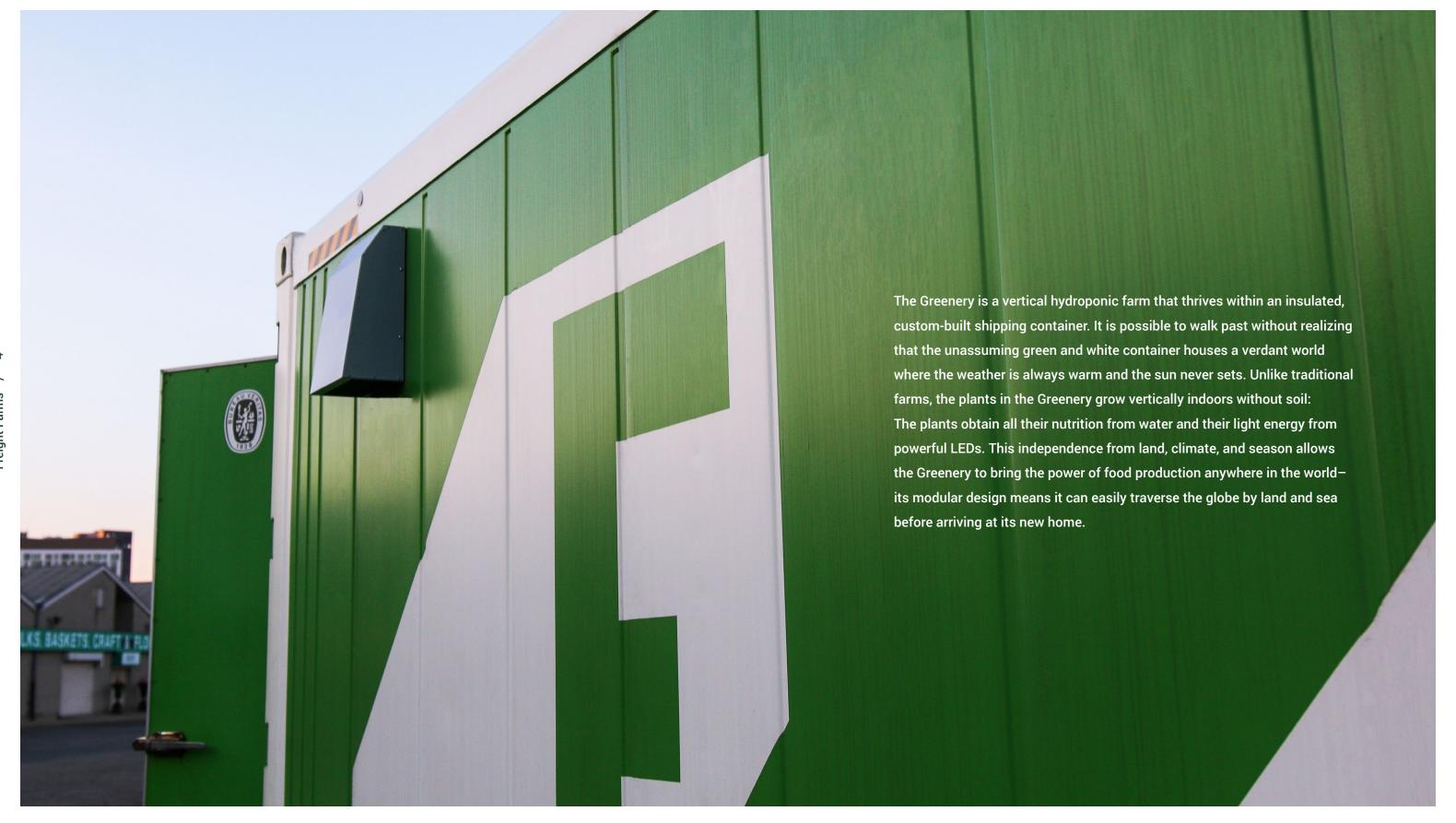
MACHINE • ERY

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.





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 70°F in extreme climates ranging from -40°F - 130°F 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.

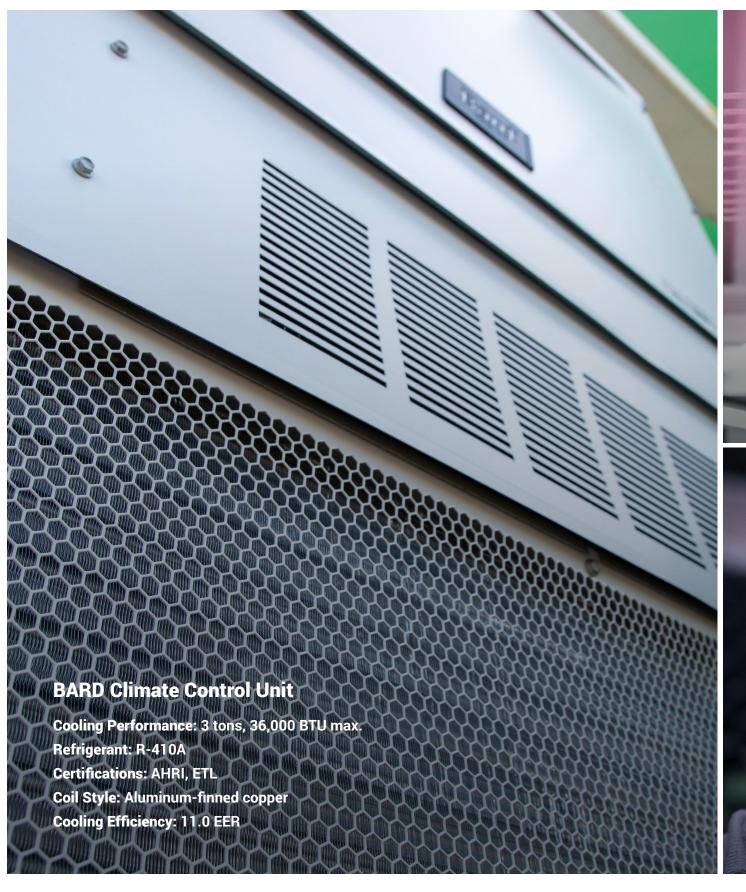
D. Airflow Ducts

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

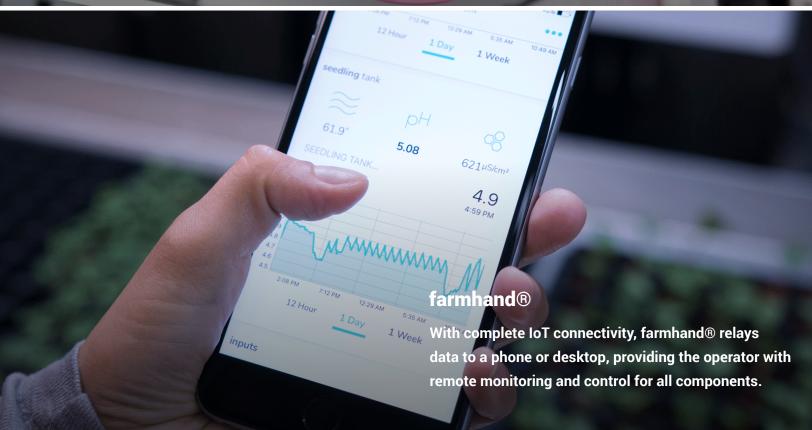
E. CO₂ Regulator

A precision regulator with a safety shut-off feature provides plants with the CO₂ needed for photosynthesis. CO₂ is fed directly into the airflow ducts and permeates into the main cultivation area.

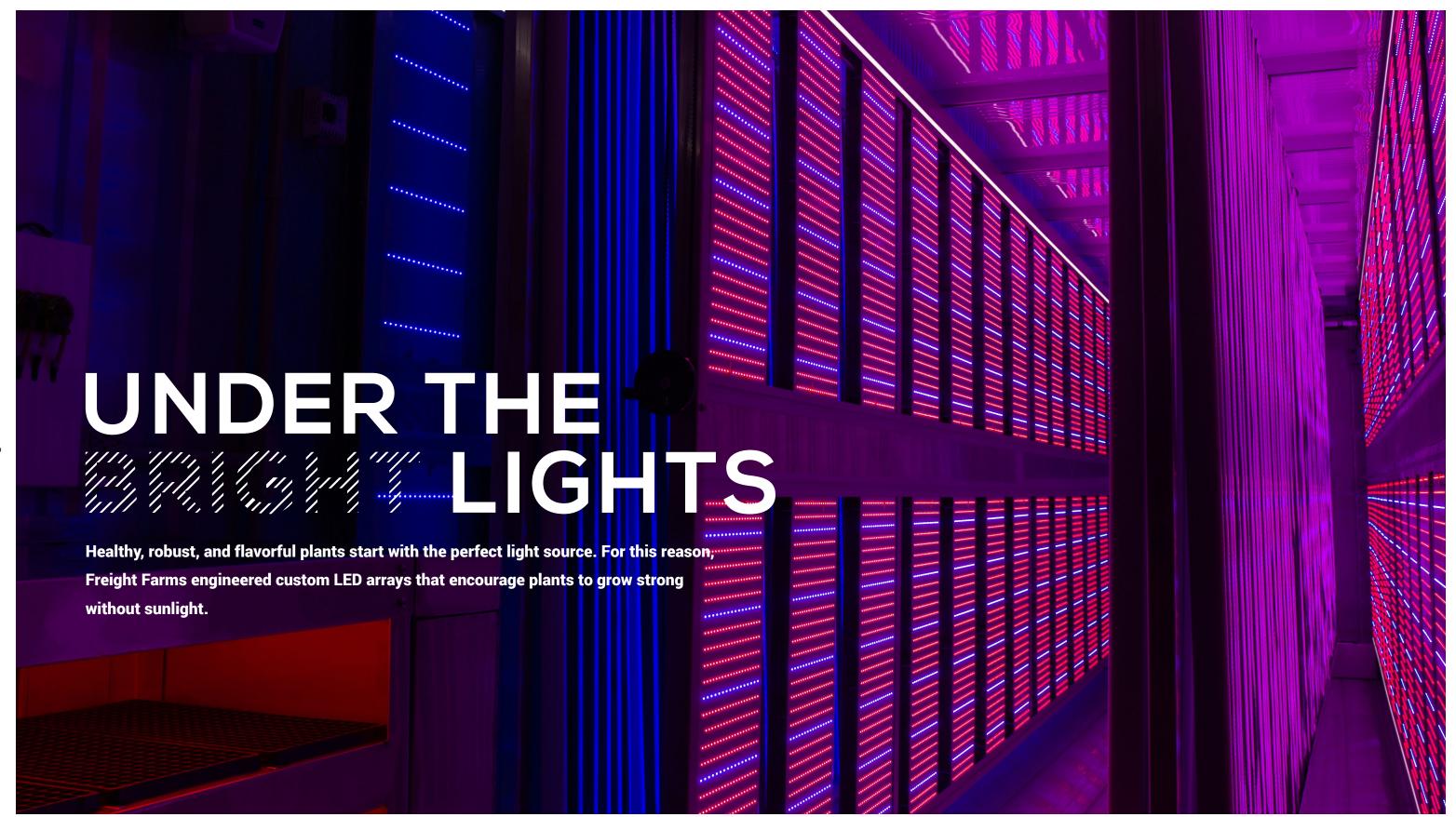








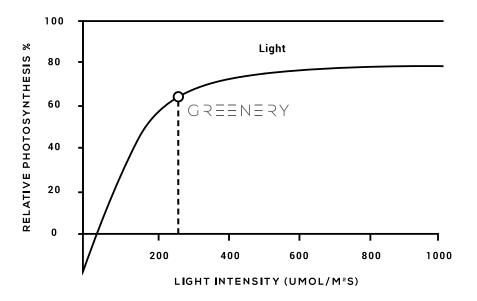




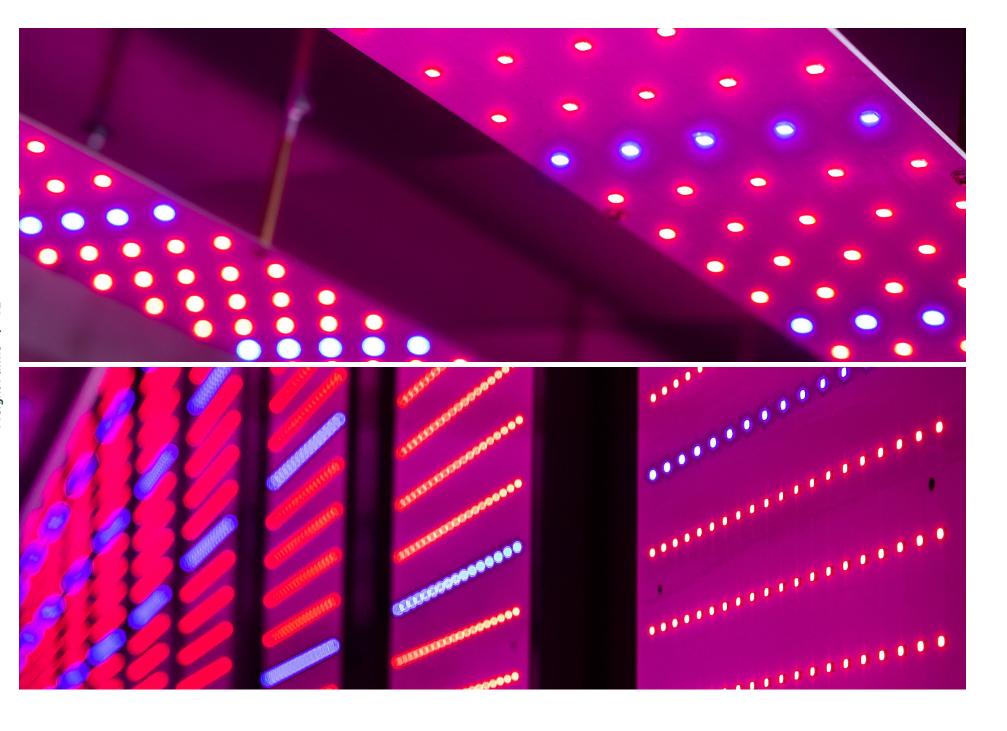


Balance of power

In the cultivation area, the Greenery's LED arrays output an average range of 250 μ mol/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 μ mol/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 μ mol/m²s, but decreases significantly beyond that point because the plant cannot absorb more light even if it is available. Beyond 500 μ mol/m²s, light has a minimal effect on the plant's growth.



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 ½" x 43 ½"

200 $\mu mol/m^2s$

Average PPFD

4:1 Red/ Blue Spectrum

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

CULTIVATION AREA LED

112 LED Boards

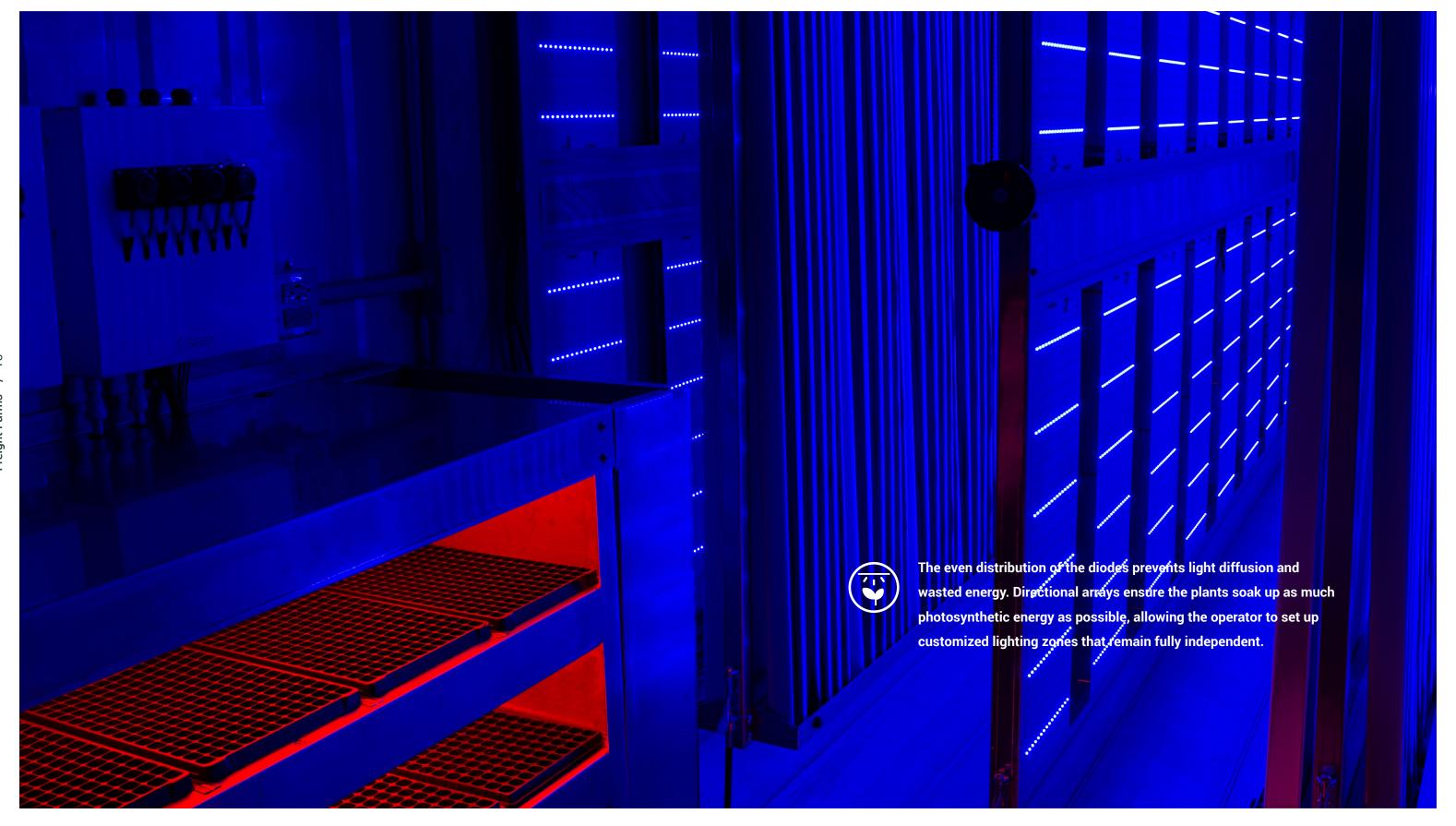
38 ½" x 13 ¾"

250 µmol/m²s

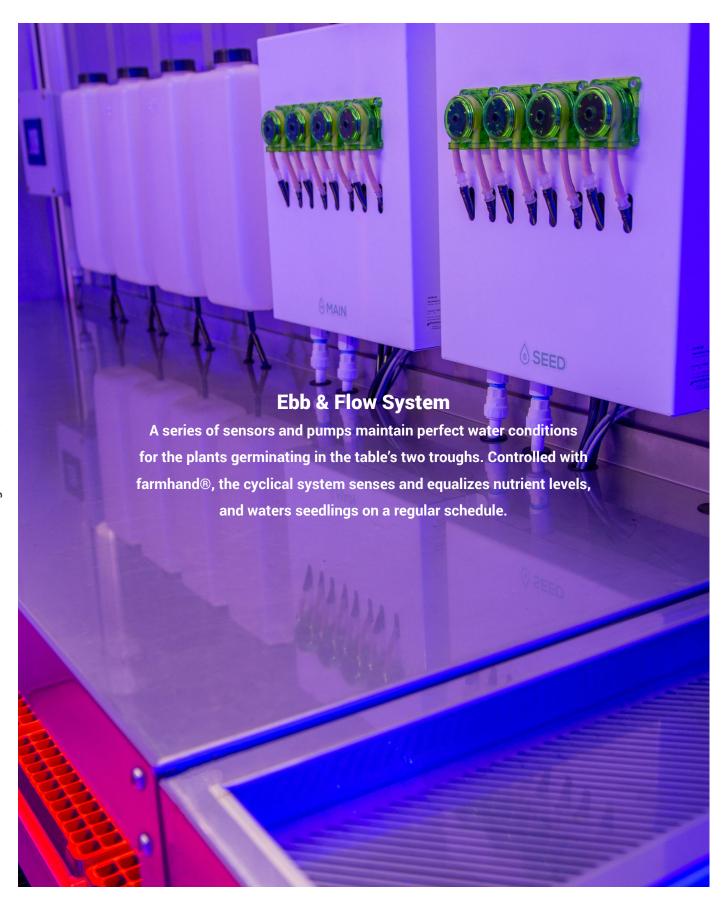
Average PPFD

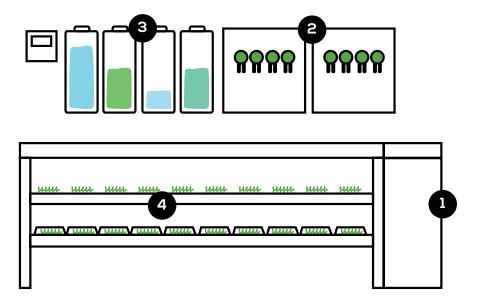
5:1 Red/ Blue Spectrum

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









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

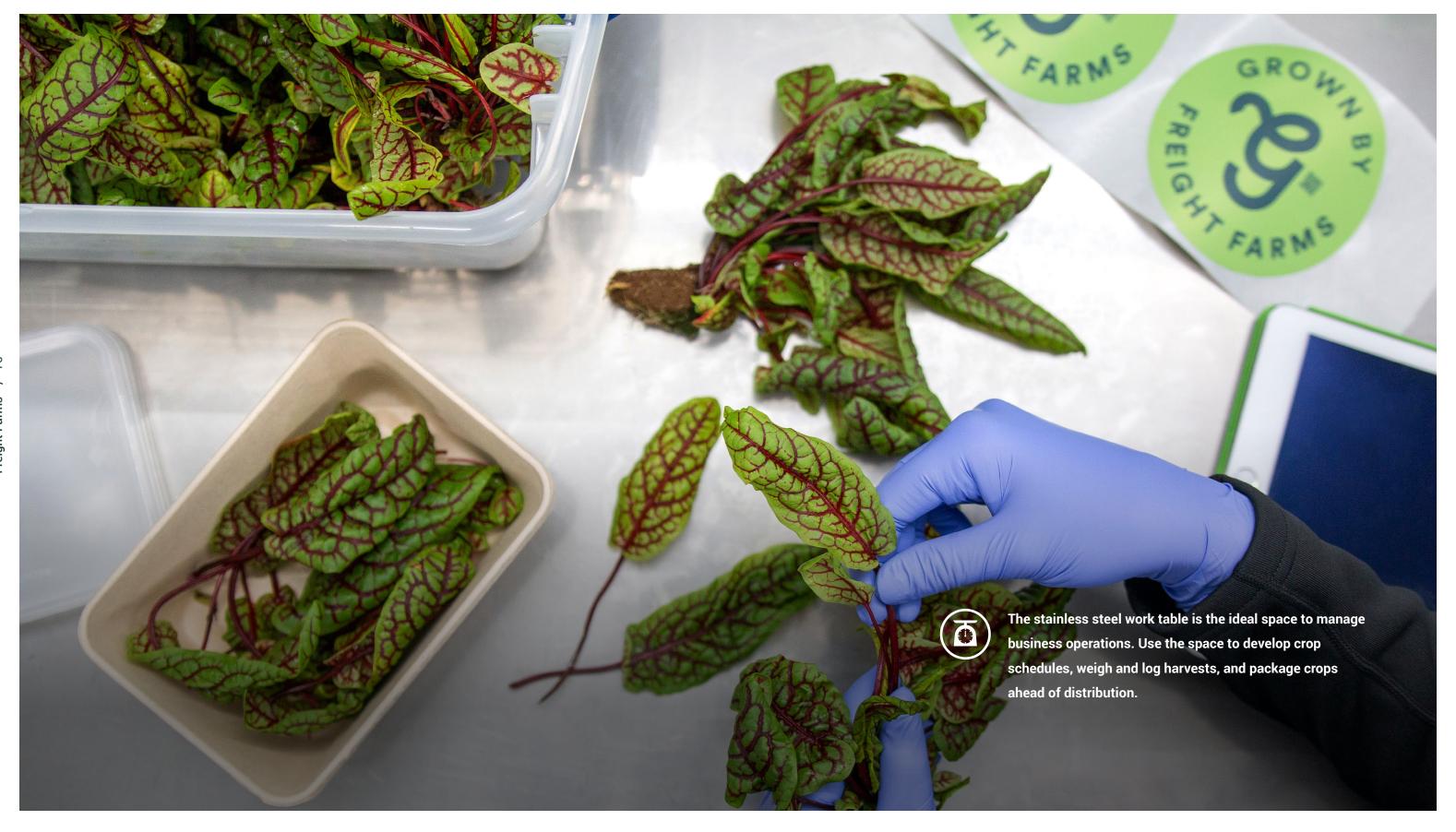
Nutrient, pH, and temperature sensors monitor water conditions and relay data to farmhand®. Peristaltic pumps automatically dose nutrient and pH solutions to maintain levels around predetermined set points.

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.



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

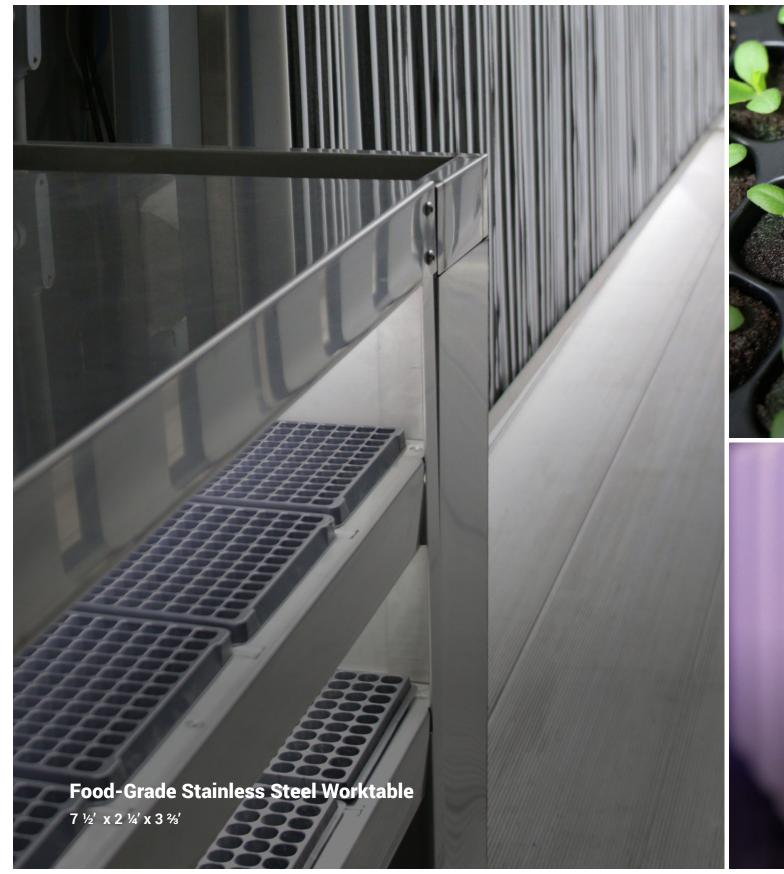
Keep a watchful eye on the Greenery with a farmhand-connected camera. Use the camera for added security, or stitch the photos together to create time-lapses. Easily add additional cameras, available for purchase on farmhand® Shop.

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

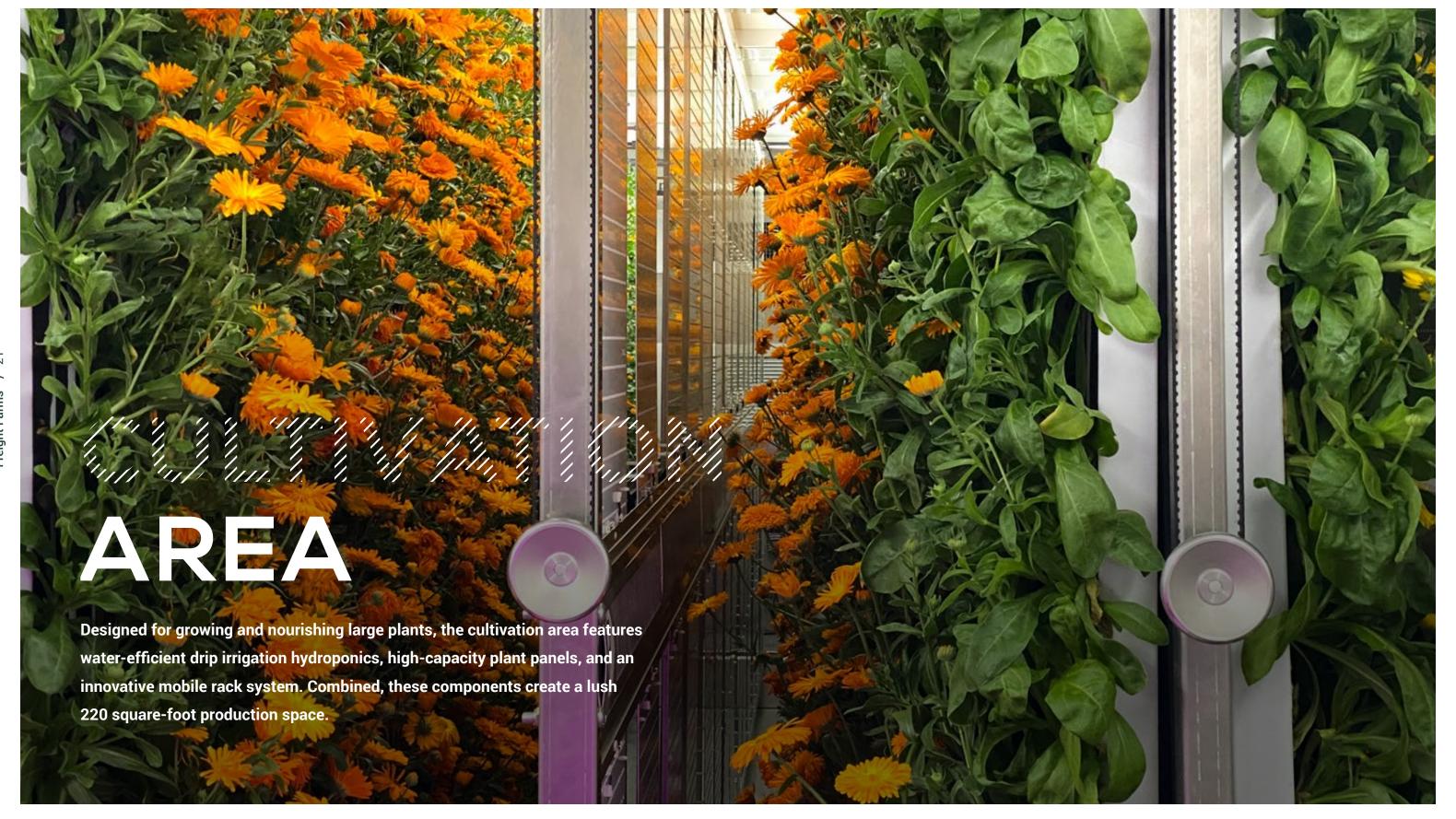
Create a pleasant work environment with ambient music from the Greenery's two wall-mounted Dayton Audio IO525 premium weatherproof Bluetooth® speakers. By creating small vibrations in the air, music can stimulate plant growth and make the plant cells stronger.

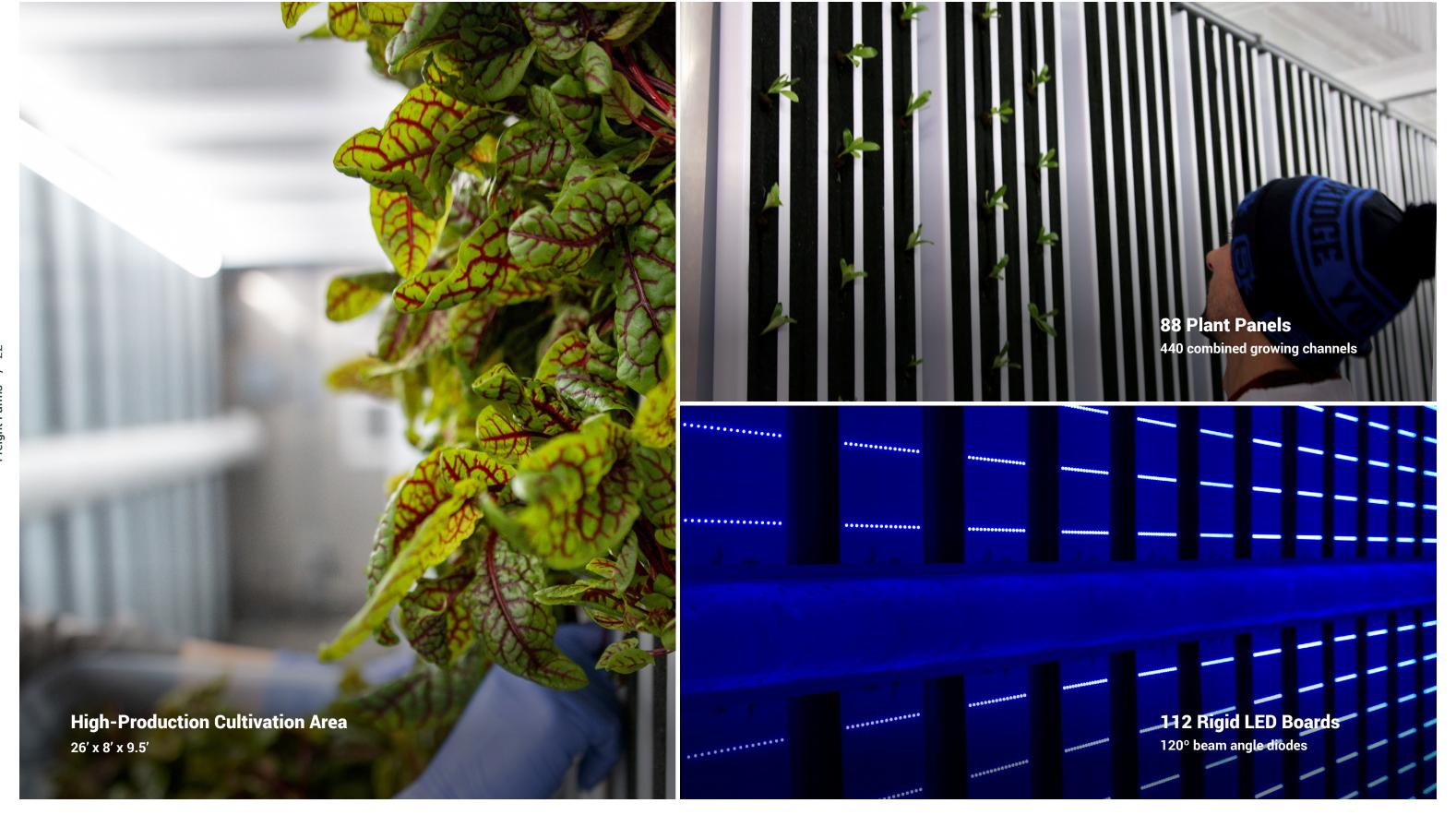








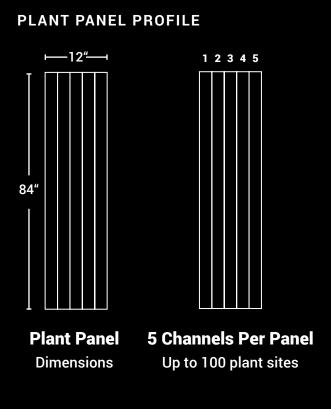




Expert Panel

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.

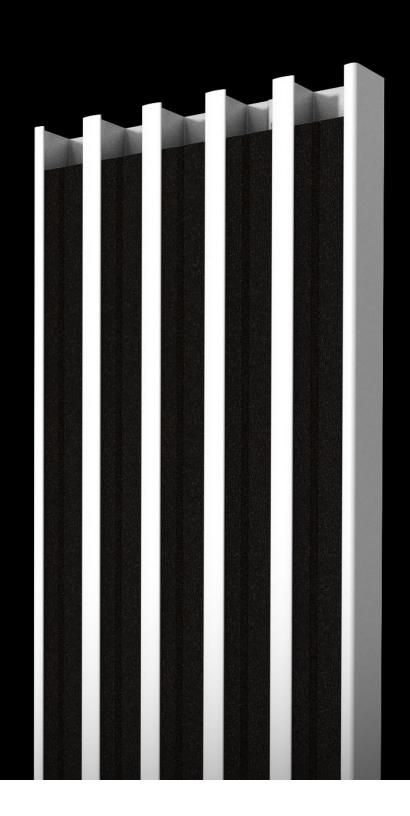
The lightweight and sturdy removable panels are shaped from food-safe, high-impact polystyrene. All five channels are paired with a reticulated foam growing medium and an anti-drip wicking strip, which gives plants a structure on which to grow while making sure moisture remains at the root.

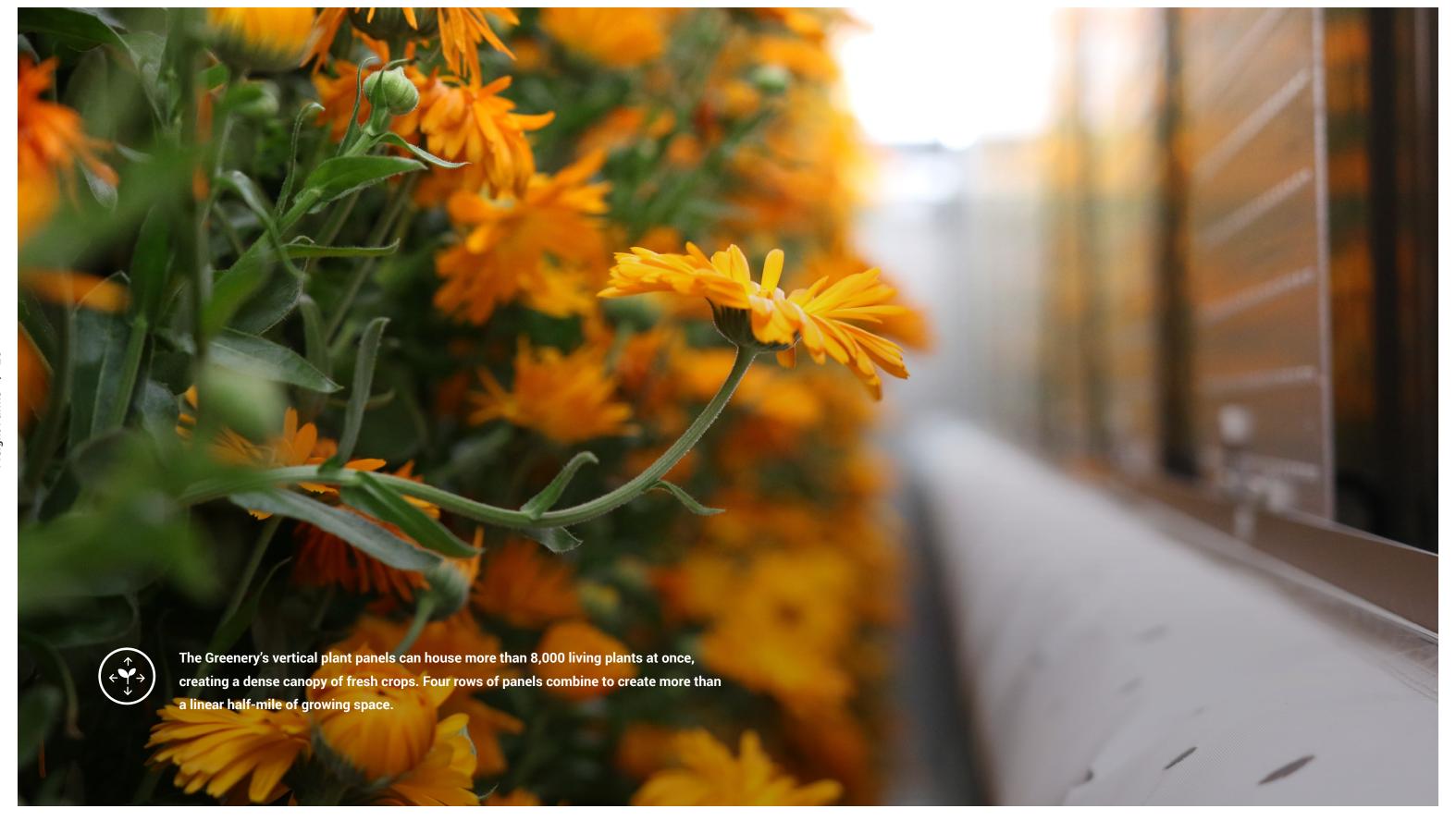


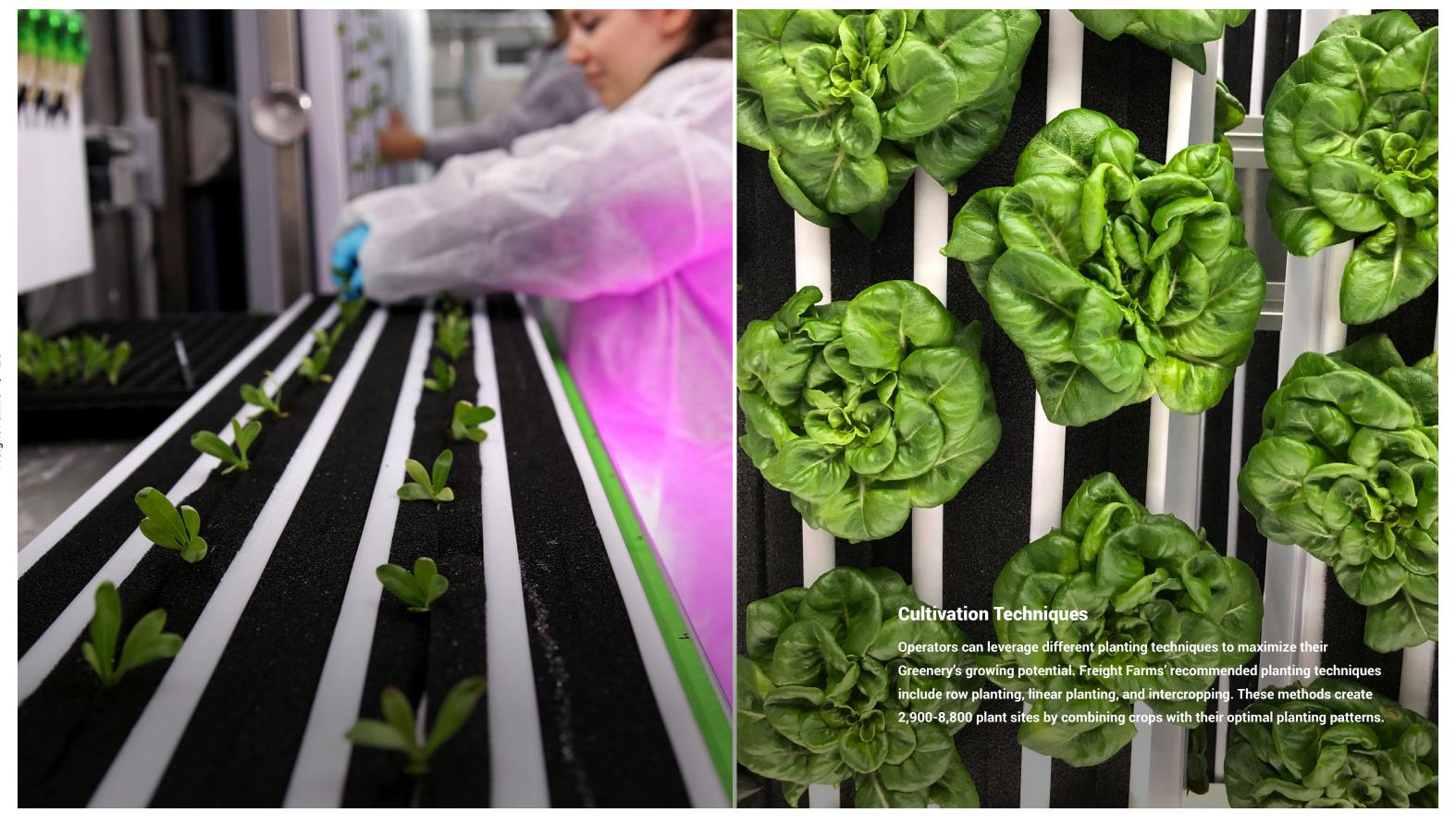
88 Plant Panels
Up to 8,800 plant sites

BUILT FROM

High-Impact Polystyrene
Food safe panel material













Row planting

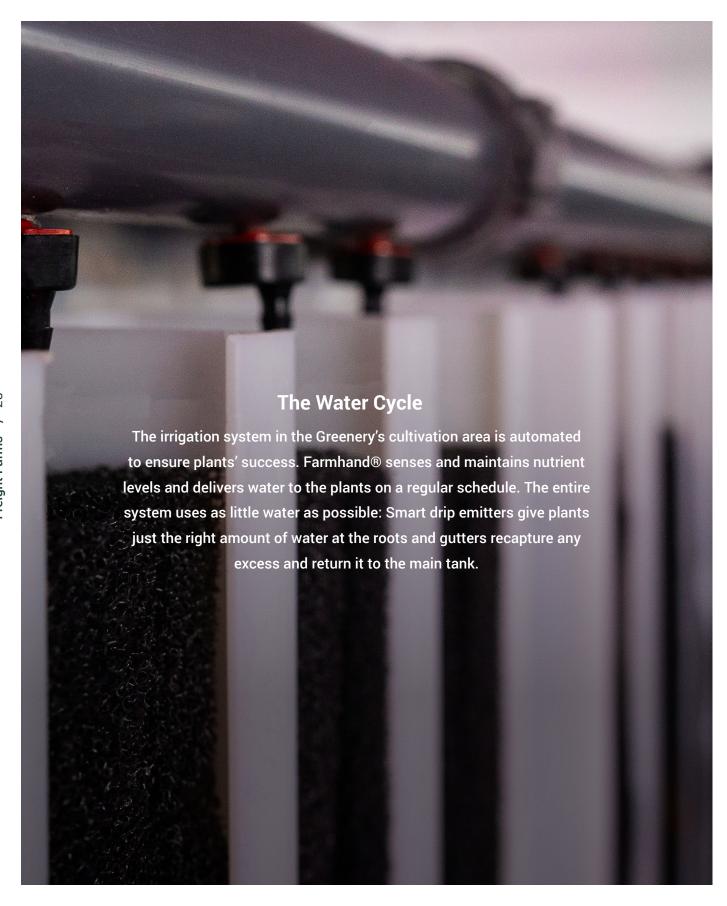
Active channels	135
Plant sites per channel	10-15
Total farm plant sites	2,600-3,900
Recommended crops*	Large crops: Lettuces, kale, mizuna, Swiss chard

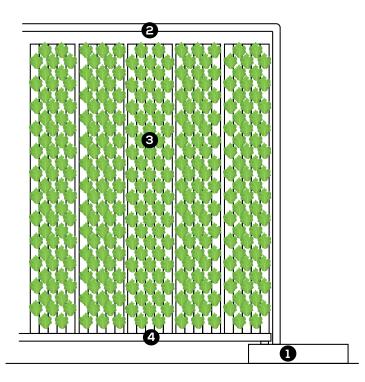
Linear planting

Active channels	12345
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	12345
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





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

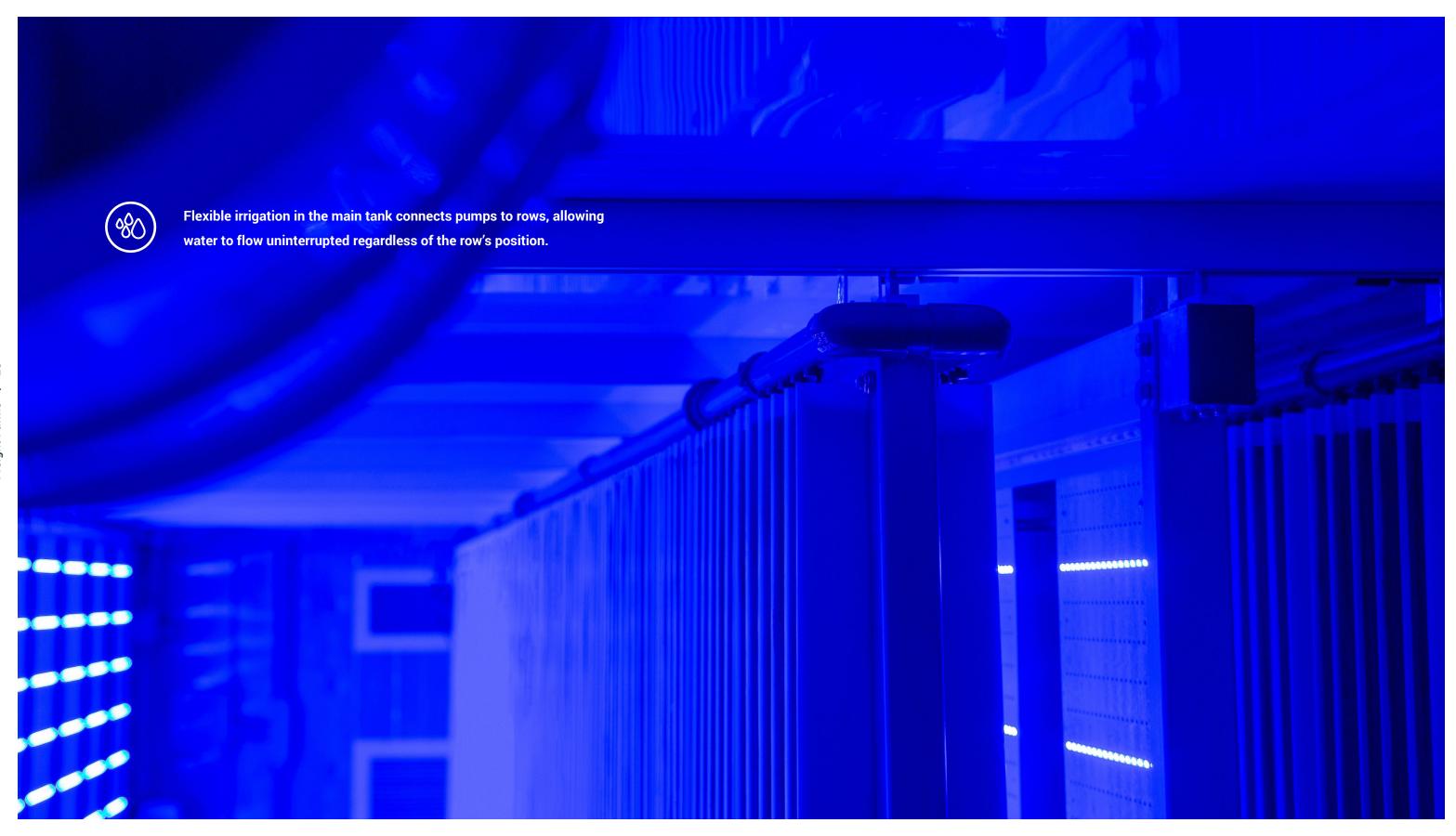
Pumps send nutrient-rich water from the cultivation tank to overhead plumbing at regular intervals based on a pre-set watering schedule. 440 pressure-regulating emitters control the water flow at a continuous drip, as water travels towards the ground at a rate of 2 gallons/hour.

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.



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

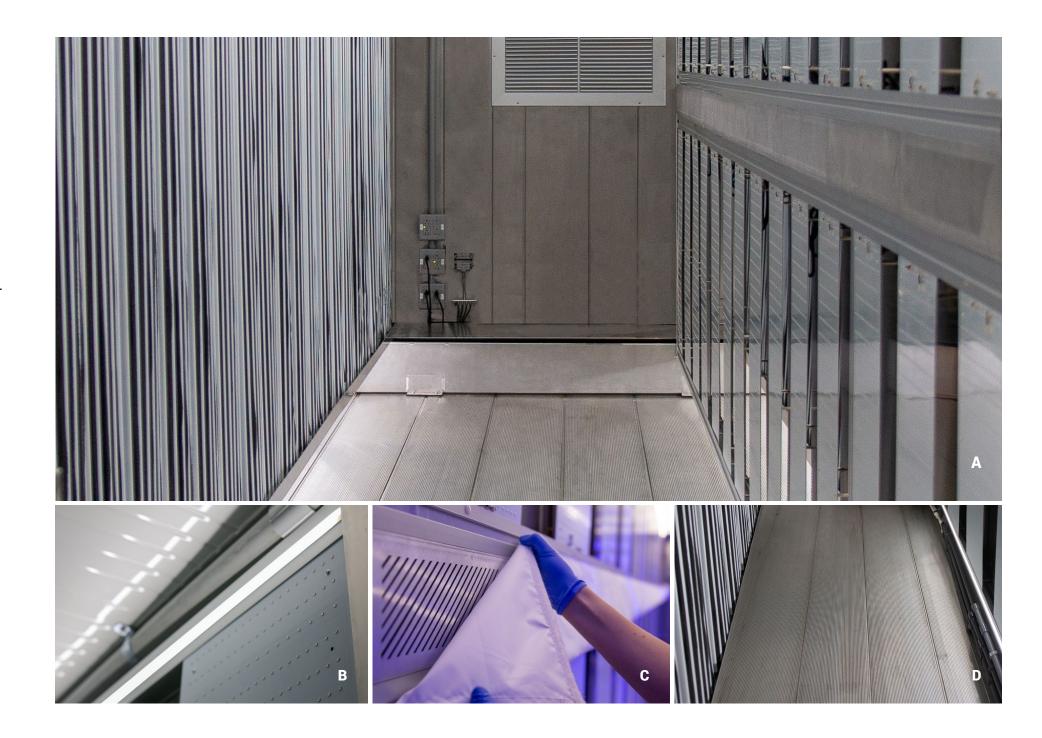
LED work lights run along the top and bottom of the rows, illuminating the space for operators as they work in the farm. The work lights emit a white light that is simultaneously gentle on the eyes and bright enough for in-depth cleaning and plant care.

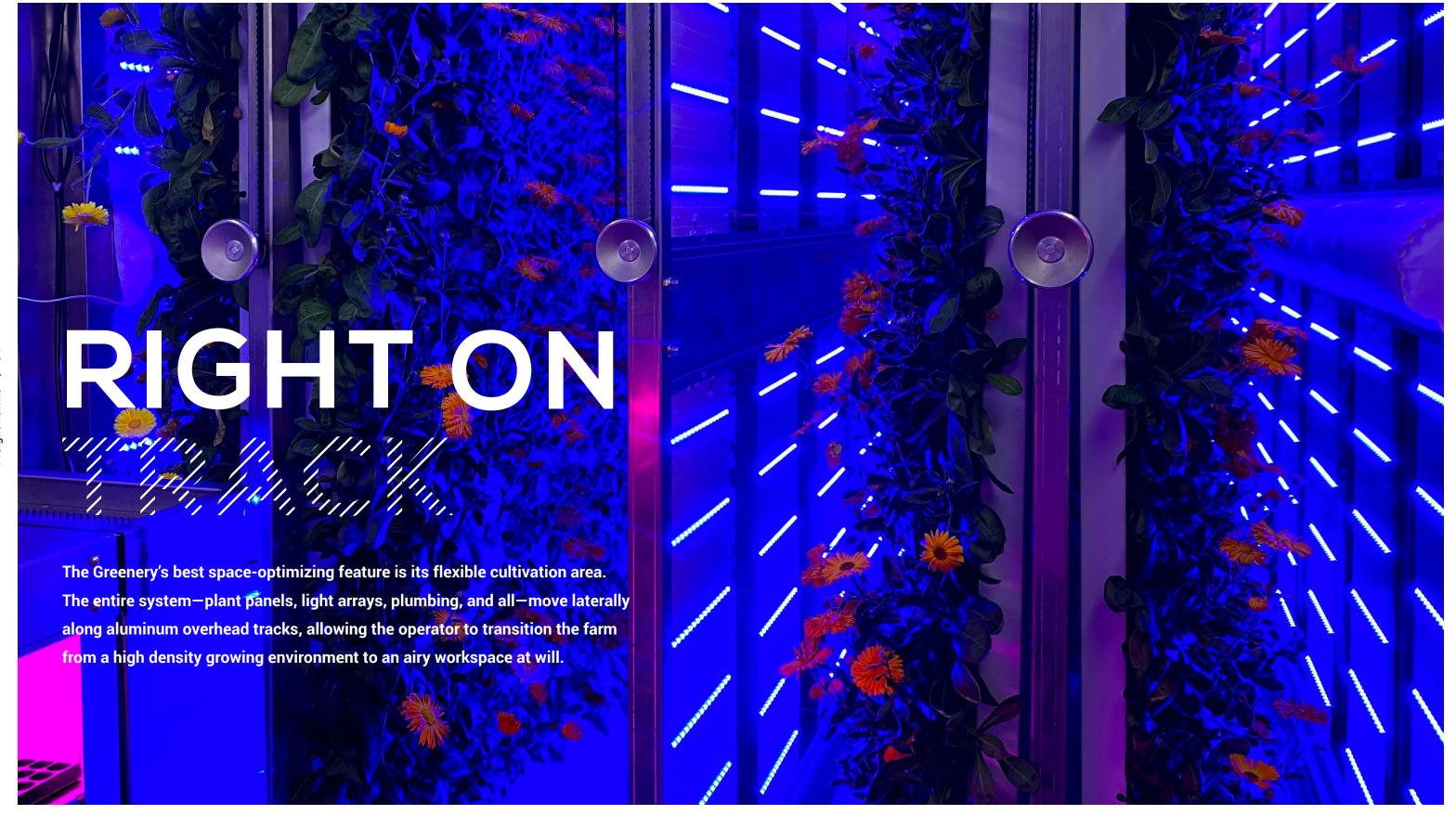
C. Removable Ducting

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.

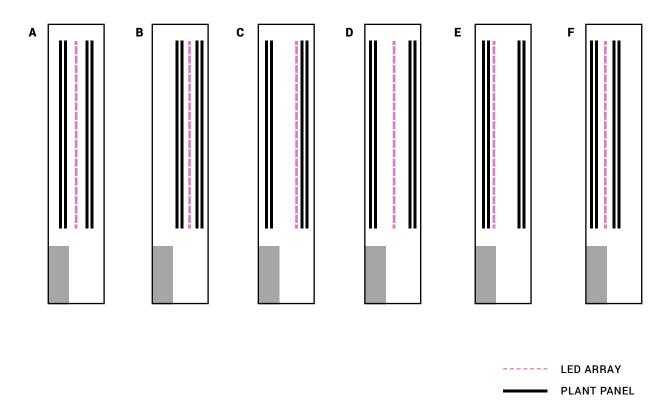
D. Easy-to-Clean Surfaces

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.







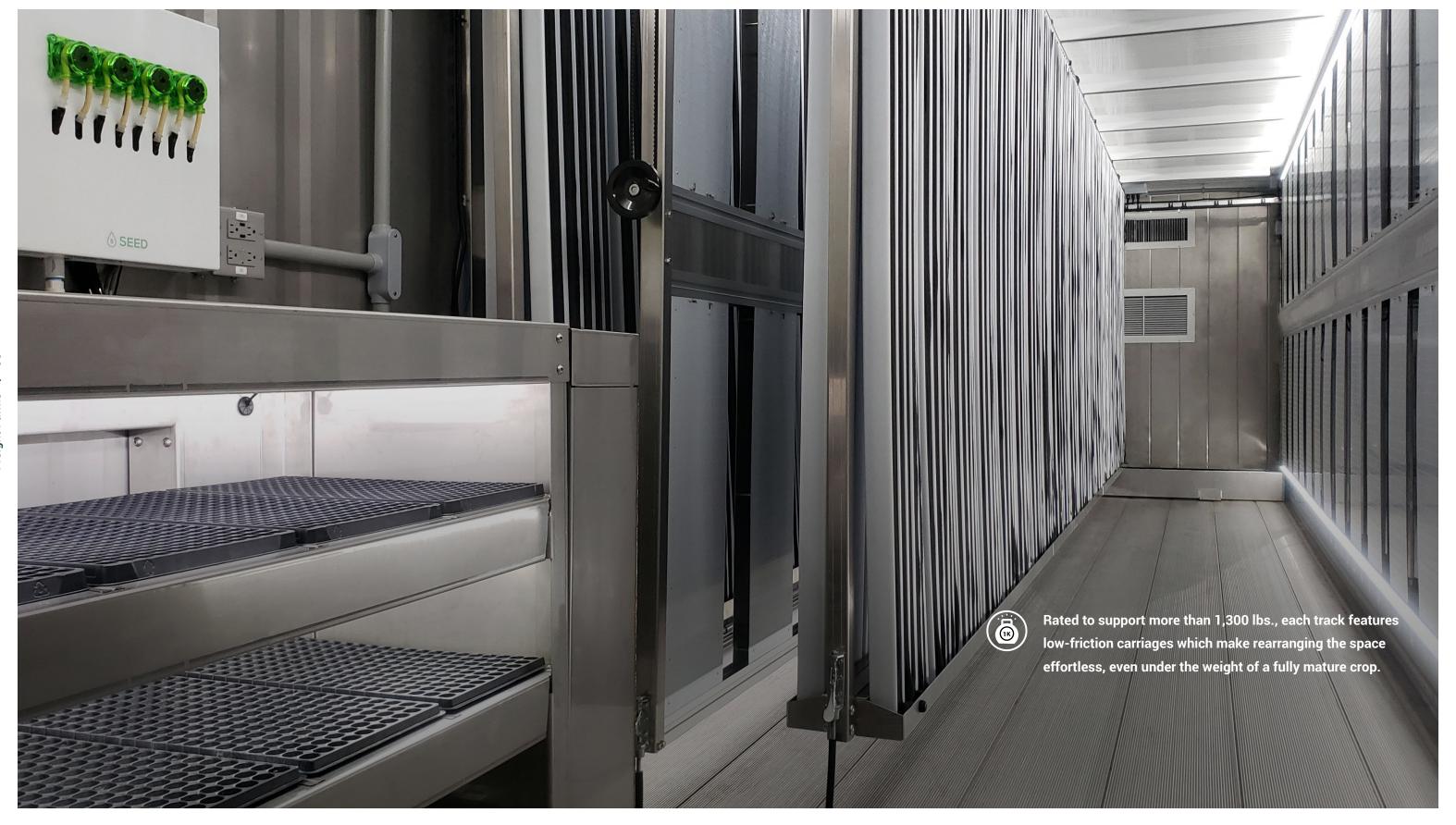


A. Standard Growing Position

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.



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

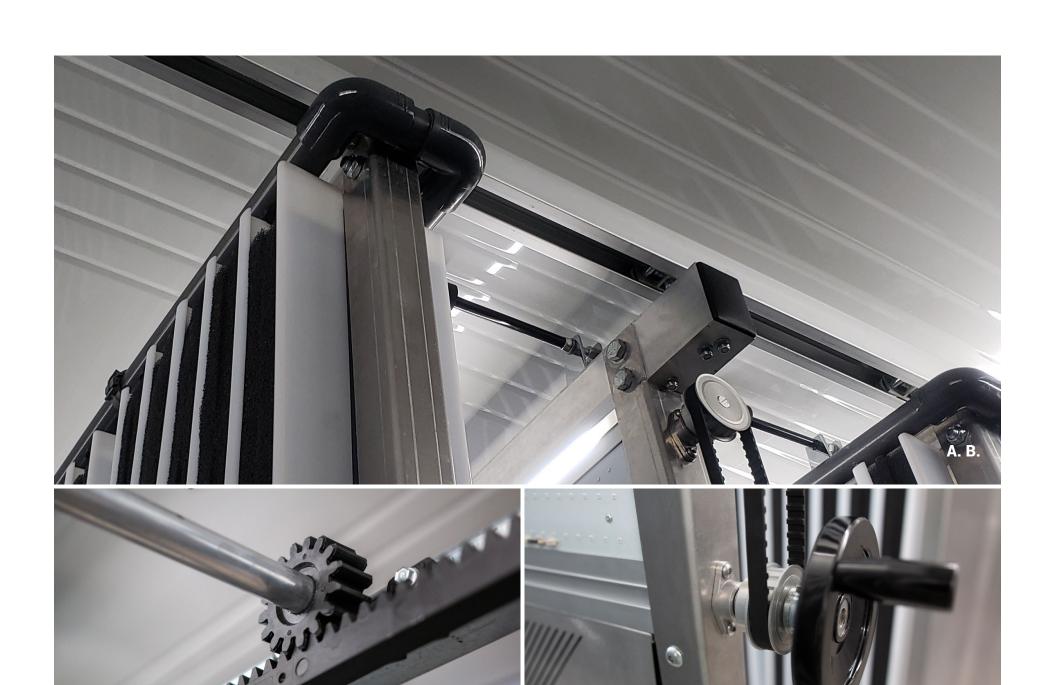
Eight anodized aluminum tracks are set perpendicular to the Greenery's frames and are the structures that allow the frames to be shifted laterally to create more direct plant access or custom row spacing. Overhead rubber stoppers prevent frames from colliding during adjustment.

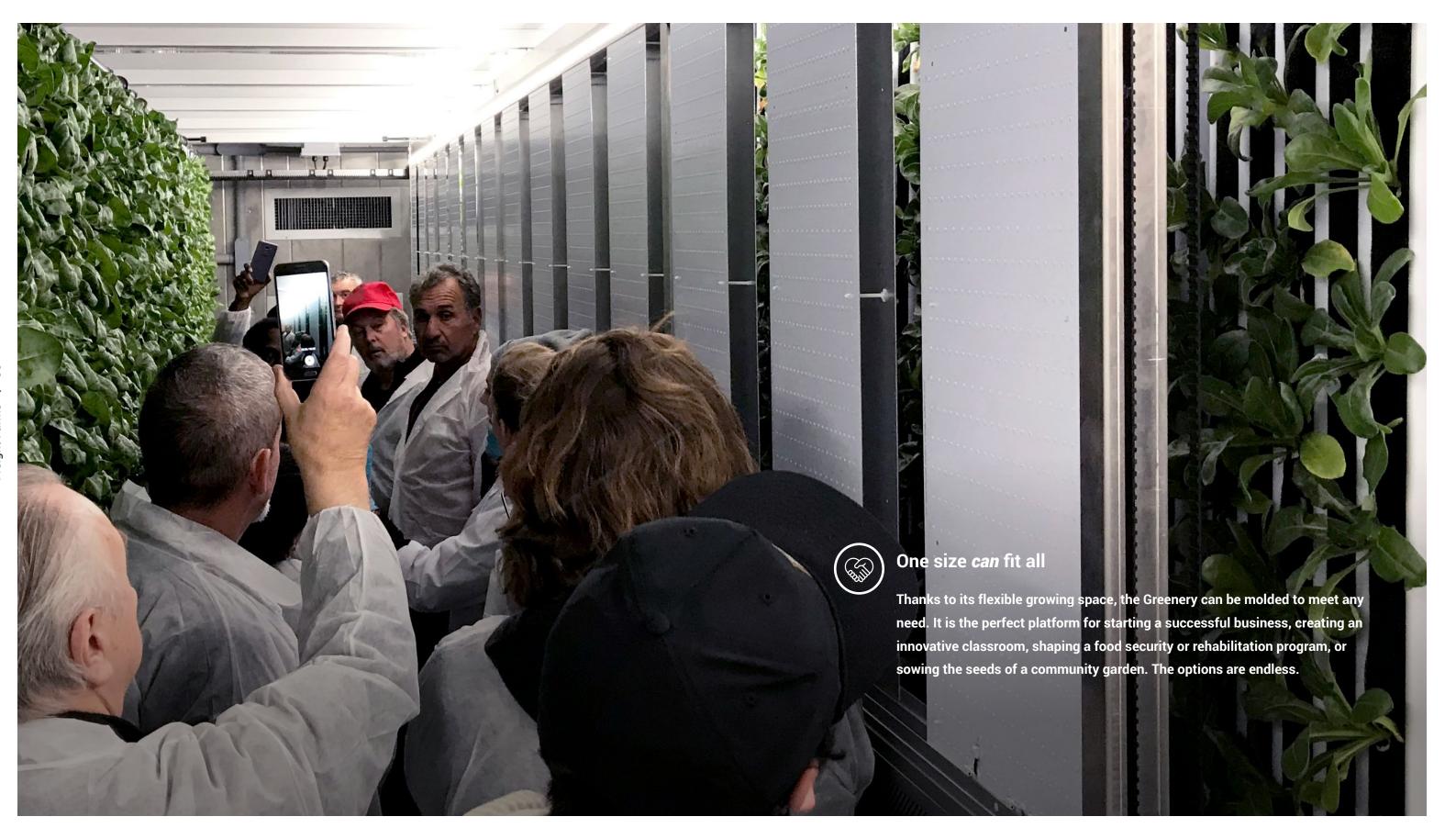
C. Carriages

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.



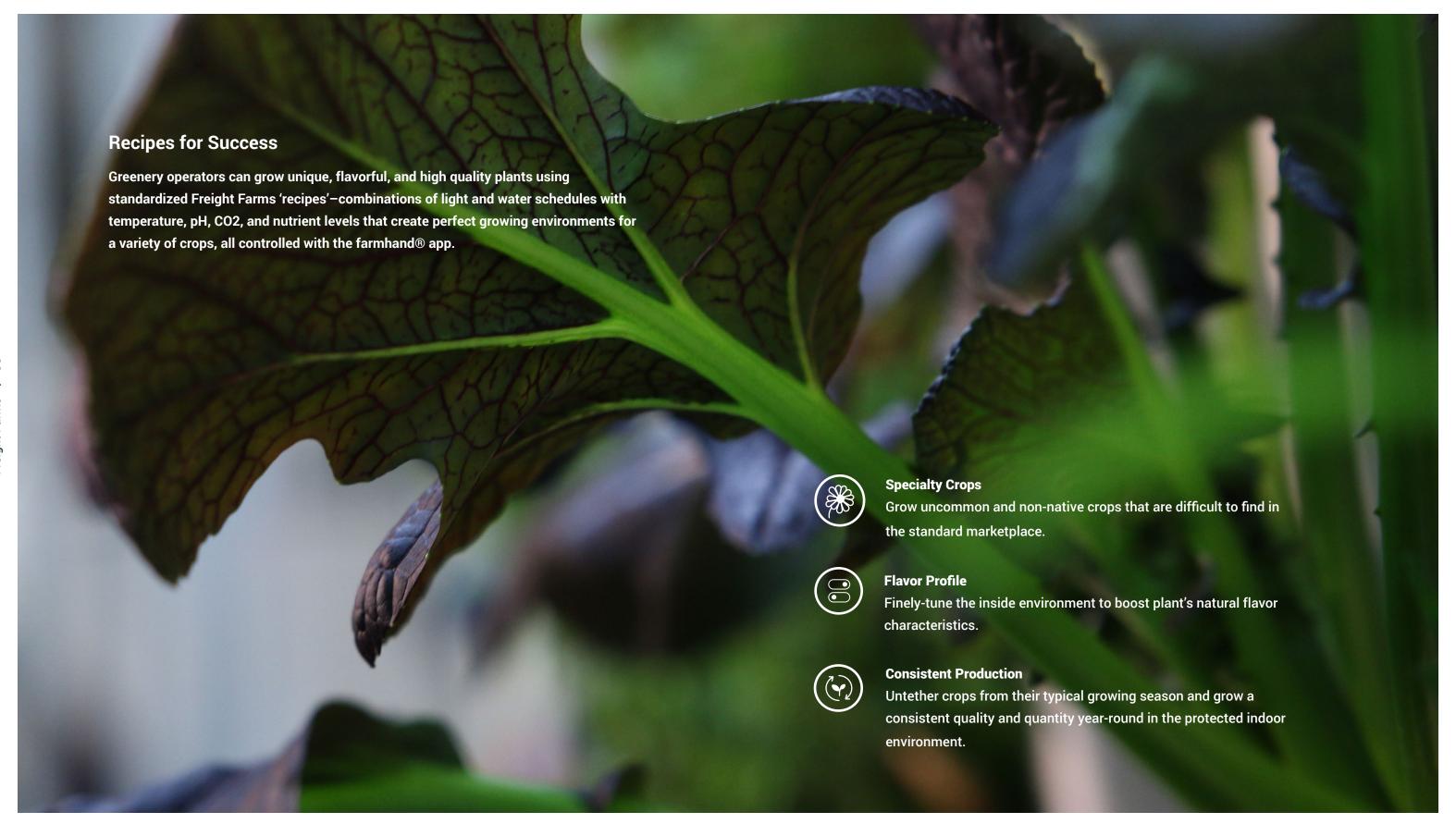






Hundreds of Varieties

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.











The Whole Life Cycle

Seeding

The plant's life cycle begins when seeds are planted in peat moss grow plugs. The peatmoss 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

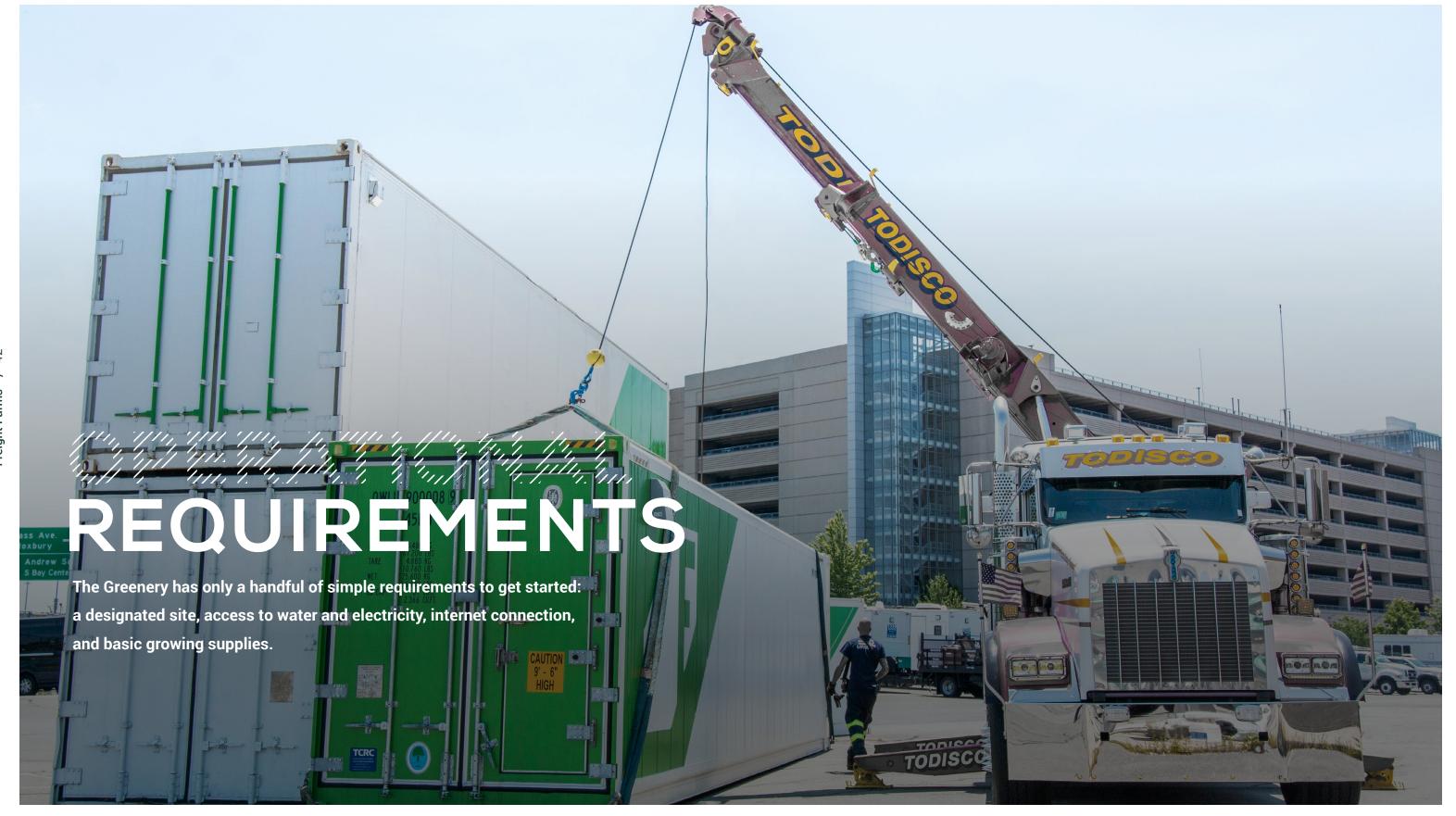
Seedlings are transplanted into the main cultivation area where they grow vertically for the first time. The roots (still in the peat-moss grow plug) are wedged into the the plant panel's stiff foam, which provides firm support and access to nutrient-rich water. The plants face outwards towards the LED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



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.



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 75°F, 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/m²s 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/m²s average
LED Array Ratio	5:1 red / blue
LED Wattage	2,030W per array, 8,120W 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

110 gal. NSF61 PVC

2 gallons/hour

Self-flushing, clog-resistant

Main Tank Capacity

Drip Emitter Flow Rate

Plumbing

Drip Emitters

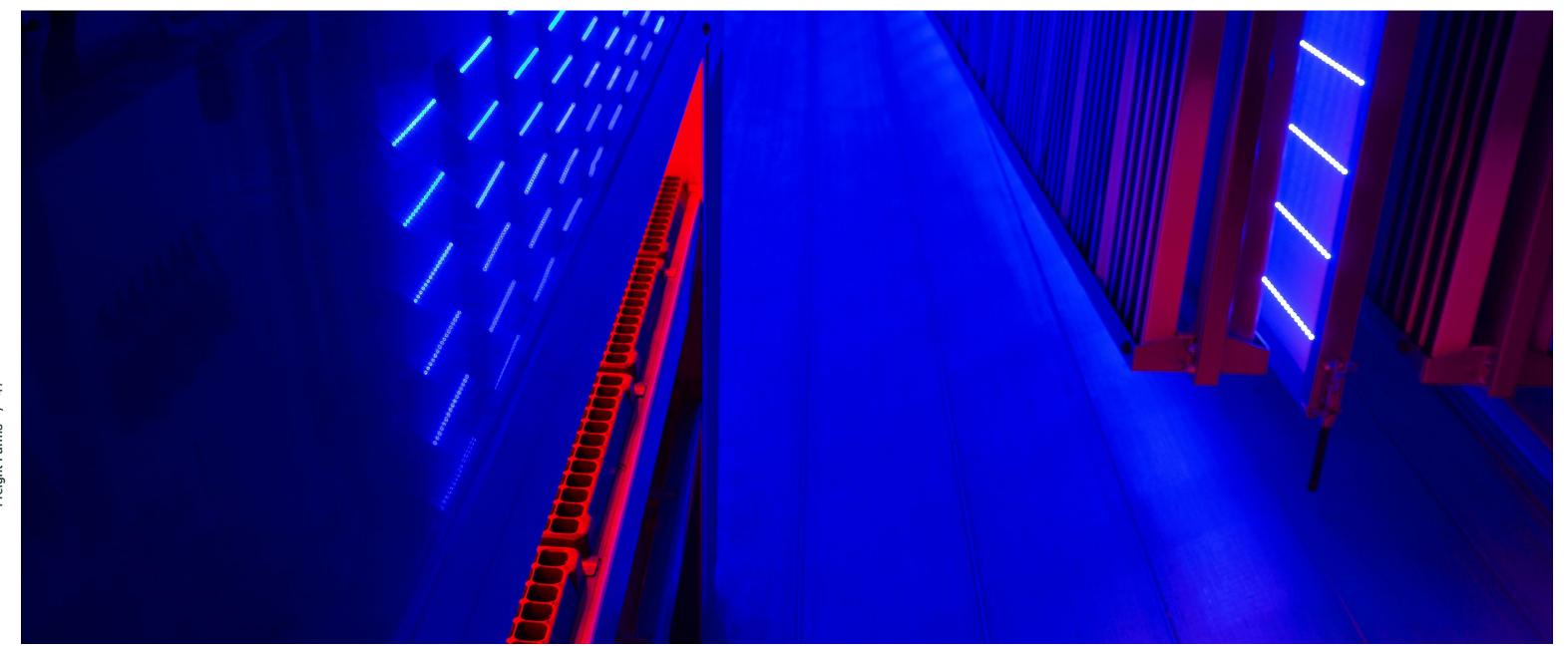
GREENERY SPECIFICATIONS

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%, ${\rm CO_2}$)
	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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