

The background of the entire image is a vertical farm. It shows multiple levels of plants growing in a controlled environment. The plants are green and appear to be cannabis. The structure is made of metal frames with various components like lights and irrigation systems. The perspective is looking down a central aisle between the rows of plants.

EVOLUTION

OF VERTICAL FARMING

FREQUENTLY ASKED QUESTIONS



YOU ASKED... **WE ANSWERED**

From the early adoption of multi-tiered nurseries to the cutting-edge farms of today, the vertical farming industry is constantly evolving and growers must adapt to these changes to stay competitive in the industry.

Read on for some **frequently asked questions** that growers have about creating a successful mobile vertical grow space.



Q1

ARE THERE ANY LOGICAL REASONS TO BUILD A NEW CULTIVATION FACILITY WITH HID OR HPS LIGHTING?

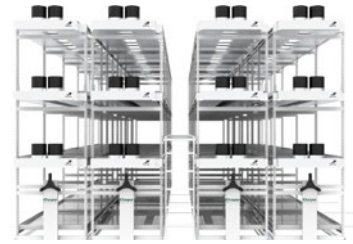


While we have seen examples of multi-tier facilities using HID lighting, **we do not advise it**. Those facilities are few and far between. The mounting distance between the lighting fixture and the canopy, along with the heat load HID lighting produces, both present challenges for vertical applications.

Consider more than the operating cost (power draw and heat load) of HPS fixtures, but also the recurring costs of new bulbs and the labor to replace them and clean the reflectors. LED fixtures also significantly reduce the risk of a fire in your facility compared to HPS fixtures. Furthermore, the efficiency and performance advancements with LED horticultural lighting have made HID technology all but **obsolete**. Eventually, facilities using HID lighting will simply not be able to compete with those utilizing LED technology and their lower cost of production.

Q2

HOW DO I SUCCESSFULLY TRANSITION FROM SINGLE-LEVEL TO MULTI-TIER GROWING?



During the design phase, make sure to **leave adequate space** in front of, behind, and above the racking structures. While this does maximize your room utilization, a common issue we see is overcrowding the room with canopy and not leaving enough space for air to mix and flow. Be careful not to choke the room out and prevent sufficient airflow. Then consider how the increased plant counts in vertical environments generate a higher overall transpiration rate in the room which requires additional cooling and dehumidification capacity from your HVACD system. Not leaving enough room for airflow and undersized dehumidification capacity are two of the most common room design mistakes we see when transitioning to multi-tier growing.

Secondly, during operation, pay close attention to how long you are vegging your plants. **Over-vegging** for cultivators new to multi-tier growing is a common issue we see which can restrict airflow, cause photobleaching, and make canopy management difficult; all resulting in poor plant health and yields. Keep up with your canopy management (defoliating and training) and try to reduce your veg time if you are having trouble with plant height in flower.

HOW **AUTOMATED** ARE MOBILE VERTICAL RACKING SYSTEMS?

Q3

The racking systems themselves are not inherently automated. They require manual manipulation of a drive box (wheel) to move the racking systems back and forth. However, many of the other systems in these grow rooms (i.e. HVAC, dehumidification, fertigation, CO₂, lighting, etc) are all becoming integrated into central control and automation systems to **streamline their operation** and allow for remote access and monitoring. We see a potential in the future for also automating the benching systems, much like in high-tech greenhouses today, to move plants from one production area to another. All automation of this kind helps to reduce labor costs and allow for a more consistent end product.





Q4

WHAT IS THE **AVERAGE SIZE OF COMMERCIAL GROWS THAT USE MOBILE VERTICAL GROW SYSTEMS?**

Great question, but truthfully, this is tough to answer because it depends on your situation and your market. Generally, for a cannabis grow, anything over **5,000 flowering canopy square feet** tends to be a good candidate for multi-tier cultivation for the full facility.

However, even if you have less canopy than that, say 2,000 canopy square feet, multi-tier still makes a lot of sense for your vegetative or mother rooms. It all depends on your local regulations, what price point your market can accept, and where your facility is located. We have installed vertical mobile racking in buildings as small as 2,000 square feet up to buildings as large as 400,000 square feet. The average size of a facility utilizing vertical mobile racking is around **25,000 square feet** but we believe this is largely due to local cannabis regulations dictating production limits.

Q5

ANY THOUGHTS ON
THE USE OF **DIRECT UV
LIGHTING** TO PREVENT
INFECTION, MILDEW,
ETC ON CROPS?

CAN THIS REMEDIATE
**NON-VALUE ADD
TOUCHES?**

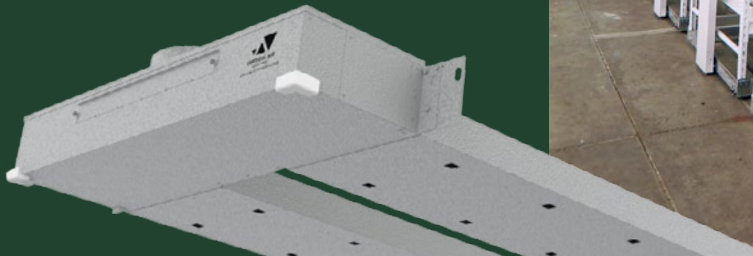


The use of UV-C photons to prevent pathogen pressure on crops is promising **if used and applied correctly**. It shows promise when used within HVAC ductwork to sterilize the air stream, but should not be applied directly to plant canopies as it can cause **plant cell death**. More research and third-party testing needs to be done to appropriately size UV-C systems for this application and determine the particle loads in these facilities. We often see vendors guess on the sizing without any real data or metrics to back up their claims, which drives the cost of these systems up for the cultivator.

Q6

HOW DO YOU MAKE SURE CO₂ GETS EVENLY DISPERSED THROUGHOUT THE GROW ROOM?

Great question! To ensure that CO₂ gets dispersed evenly throughout your room, you first need to make sure that air is getting mixed evenly within your room. For that to happen, you need to have a well-designed supply air and return air HVAC ductwork configuration along with a good in-rack airflow system, such as **Vertical Air Solutions**, to move air within the room. Once you have an even mixing and flow of air within your room you can inject supplemental CO₂ into your HVAC supply ductwork and know that CO₂ is reaching every plant on every tray. To get good CO₂ dispersion, you **need to have good airflow**.





Q7

HOW MANY SQUARE FOOTAGE OF BUILDING IS NEEDED TO PRODUCE 350 LBS PER MONTH? HOW TALL SHOULD MY BUILDING BE FOR DOUBLE STACKING?

The size of a building required to produce 350 lbs of cannabis per month depends on a number of factors including the size of the grow rooms, whether or not the rooms are multi-tier, what genetics you are growing, and more. For you to determine this, we first urge you to **start tracking your cultivation metrics** such as yield and production timing. Then you can reach out to design/build professionals and vendors, such as Pipp, to help design a facility that is right for your business plan.

In regard to the ceiling height required to double stack cannabis in flower, we recommend a minimum of **14-16 feet**. You can get away with slightly less, but you run the risk of choking the room out and restricting airflow.



WHAT IS THE STANDARD RACK WIDTH OFFERED FROM PIPP? DO YOU OFFER CUSTOM SIZING?

Q8

The most common rack width we see for cannabis is **4 feet wide**, and this is primarily driven by the standard 4'x8' grow trays the cannabis industry has adopted. However, other widths are available, including 3' and 5', depending on your preferences and room designs. For any **custom widths**, please reach out to us and our engineering team will determine if it is feasible.

Q9

THERE'S OFTEN A DISCONNECT BETWEEN THE BOARD ROOM AND GROW ROOM. HOW HARD IS IT TO OVERCOME THE “CFO /GROW HURDLE” SO CULTIVATORS AREN'T REPEATING THE SAME MISTAKES? WHAT ARE THOSE COMMON MISTAKES?



What a fantastic question, is it the cultivators that are making those mistakes, or is it the executives? All the board room sees and understands is what's on the excel spreadsheets, it is up to the cultivators to make sure that the numbers being entered into those spreadsheets are **realistic and achievable** based on the project budget and their skill as a grower. The best thing a cultivator can do to avoid the common mistakes with room designs and operations is to know their numbers and ensure they are accurate. The best thing an investor or the board room can do is to better understand the nuances and variability of cultivation while keeping in mind that farming is not an exact science like a manufacturing process is.



Contact **Pipp Horticulture's** experienced team of indoor cannabis operators and designers to take the first step towards your vertical farming future!

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