



## **Why did we write this guide?**

### Introduction

As you know, planting a seed and watering may not necessarily lead to great results with your first urban farming project.

We've talked to thousands of Urban Vine Co community members, and they've asked tons of questions about how to get started with urban farming.

Over time, we noticed something. The same questions kept on popping up over and over.

This e-book is full of actionable steps you can follow to make your first urban farming venture successful.

Those pictures online of beautiful indoor systems with amazing looking crops?

This guide will help you get there.

### **Who is this guide for?**

If you've read about the benefits of urban farming and want to start your first urban farming project, **this guide is for you.**

If you've read articles about urban farming, but are looking for more in depth information, **this guide is for you.**

If you are trying to decide between different styles of urban farming to start with, **this guide is for you.**

If you want to learn more about the basics of:

- urban farming for profit
- growing in especially small spaces
- starting a rooftop garden
- aquaponics
- vertical farming
- organic farming
- permaculture
- soil-less growing mediums
- troubleshooting existing urban farms

**this guide is for you.**

**How much of this guide should you read?**

If you want to have a well-rounded understanding of the basics of urban farming, you'll want to read everything.

Why might this be a good idea?

If you're a beginner in any topic, not just urban farming, it can be helpful to get a general overview and to understand your options for learning.

As an example, you may think you want to start a rooftop urban farm now, but after reading this guide, discover that growing indoors is a much better option for you.

That being said, each lesson is designed to be standalone and doesn't require you to have read previous lessons.

If you are set on a topic and want to only learn about that topic for now, then by all means, skip to that lesson!

Now that we've covered the introduction, let's move on to the lesson plan.

## **Lesson Plan**

### *Part 1: The Very Basics*

Lesson 1: What crops are the easiest with to start off?

Lesson 2: What are basic tools I need to start off?

Lesson 3: Mistakes urban farming beginners make

Lesson 4: What are the basics of indoor farming & grow lights?

### *Part 2: Next Steps*

Lesson 5: What are the basics of soil-less growing mediums

Lesson 6: Selling urban produce to restaurants + unit economics

Lesson 7: What are the basics rooftop and vertical farming?

Lesson 8: What are the basics of permaculture?

Lesson 9: What are the basics of seeds for urban farming?



# Lesson 1

## What crops are the best to start off with?

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### **An insane amount of options**

There are over 15,000 varieties of tomatoes currently grown today across the world, and that's just one crop!

That being said, growing in an indoor urban farming environment is different than large scale commercial production.

In this chapter, we will use a 2-part framework to discuss how to think about picking a crop and give some suggestions you may want to consider.

Then we will discuss the best next steps to take after picking what you will grow.

### **A two part framework for picking your crop**

The crop selection process can be broken into 2 main parts:

1) What do you want to grow?

The growing process is not always easy. Growing a crop just because it is "easier" to grow is not always the right answer.

What's the point of growing something you don't even like?

As professional vertical farmer and Modularfarms.co CEO Eric Amyot said in an interview with Urbanvine.co:

"I would actually suggest that somebody grow whatever they want to grow, there's no point in growing mint (for example) if you can't stand it, because you're not going to eat it and you're not going to enjoy it, so that might deter you from proceeding"

Obviously some crops will be very difficult to grow as a beginner and really wanting to grow this crop will only take you so far if you are a beginner. With that the second part of the framework:

2) Is your ideal crop realistic? Compare it with these 2 key characteristics of a low maintenance urban farming plant:

2 Key Characteristics of a low maintenance urban farming plant:

1) Plant size: generally speaking, a smaller plant will be easier to grow. One reason for this is that as a plant grows in size, providing lighting with even distribution becomes more of a

challenge. Another reason is that the "growing cycle" of a larger plant is longer, meaning it will take more time to grow typically.

Example: Lettuce is a popular urban farming crop. However, different kinds of lettuce grow to different sizes. Iceberg lettuce is typically a larger lettuce plant, whereas "loose-leaf" lettuces like oak leaf, salad bowl, or butter crunch lettuce will be easier to grow.

2) Pollination requirement: "Fruiting" plants that require pollination will be more difficult to cultivate. Examples of these types of plants include: strawberries, tomatoes, and cucumbers (to name a few).

These plants will also usually be "vine" or "creeping" plants, meaning that they are not suitable for growing in smaller spaces.

Examples of non-fruiting plants:

- Leafy greens
- Herbs
- Brassicas: broccoli, cauliflower, cabbage and kohlrabi
- Tubers and Root vegetables: i.e. carrots, parsnips
- Ground level root veggies such as beets, turnips, rutabagas

Note: exceptions exist: Some hybrid forms of cucumber and tomato, for example, are 'parthenocarpic' and don't require pollination.

Next Steps:

After you have selected a crop that hopefully:

- a) you enjoy eating (or your customers enjoy using them)
- b) is a smaller plant
- c) is a non-fruiting plant

The next steps to growing will be:

- Selecting correct lighting (if indoor growing): Discussed in Lesson 4
- Find your other key inputs (seeds, soil, fertilizer, etc): Discussed in both Lesson 5 and Lesson 9
- Find basic tools to help keep yourself on track throughout the growing process: Lesson 2 (next!)



## Lesson 2

### Basic tools needed for urban farming

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As discussed in the introduction, the process of growing even a single lettuce plant is not as simple as watering and waiting.

The following tools will help you

- a) measure the health of your plants
- b) prevent issues with plants before they develop
- c) maximize yield and growth in your plants

First we will start with tools for measuring the health of your plants (or future plants).

#### **a) Tools to measure the health of your plants**

1) Brix Refractometer (available on Amazon for 22\$): The health of your plant can be determined by the way light penetrates the leaf of the plant.

If the brix level is only 3 degrees or 4 degrees, this means the plant is lacking essential nutrition. Eating plants with low brix would result poor taste and low nutritional value.

As a rule, the brix level should be over 12 degrees. (Some crops like carrots and potatoes have lower brix thresholds closer to 8 degrees brix).

2) pH kit: pH in your growing medium determines the ability of the plant to uptake minerals and nutrients. Out of sync pH will sink your urban farming project!

Cheap way to measure pH: Take your soil, mix with deionized water in a water bottle (1/2 and 1/2) then stick pH paper (can be bought at local pool stores or hardware stores for close to no cost).

More expensive way to measure pH: There are pH meters for both soil and water based growing mediums, available on Amazon for less than 20\$.

## **b) Tools to prevent issues before they develop**

### Lesson 2: Basic Tools

1) NPK Soil Test Kit: NPK (Nitrogen, Phosphorous, and Potassium) are some of the most crucial elements needed for plant growth (calcium also important).

Soil test kits to help monitor your NPK concentrations are available on Amazon for 13\$. Proper balance in NPK will help

promote hearty plant growth and will reduce risk of pest infestation.

2) Fan (indoors): If you are growing in a tight space with closely packed plants and grow lights, a fan will be a great addition to your system.

Plant's greatly benefit from air circulation (they use CO<sub>2</sub> from the air for photosynthesis during the growing process), and the fan will also help keep temperature more evenly distributed if you are using grow lights.

Be sure to not blow directly on the plants, an extremely gentle and/or indirect air flow from the fan will be sufficient in most cases.

### **c) Tools to help you maximize yield and growth in your plants**

1) Liquid Fish / Kelp: This is one of the most reliable fertilizers to help nurture underperforming plants. If you use one of the tools in a) to discover a nutrition deficiency, liquid fish will be a great first step towards a solution.

Liquid fish can be found on Amazon for \$12.89 in the US. For alternatives in the hydroponic growing space, check out the products by Re-Nuble (<https://www.re-nuble.com/>). They create hydroponic nutrients using organic plant derivatives.

2) Spray Bottle: Because of the way a plant is structured, the most effective way to intake nutrients like liquid fish is often through the leaves through small openings called stoma (plural: stomata).

Because the stomata are situated on the underside of the leaves, the best way to reach them is through misting or spraying nutrients.

## **In Closing**

The biggest takeaway from this chapter is that all of these tools can be acquired quite economically.

Overall, the cost of many of these basic tools will be a very small percentage of the cost of other urban farming components like grow lighting.

For this minimal investment, you will almost certainly see ROI, whether that means a more profitable business or more food to eat yourself! (Selling to restaurants and unit economics discussed in Lesson 6).

Up next, common mistakes urban farming beginners make.



## **About Urban Farming Beginner Mistakes**

In urban farming, mistakes beginners make can be simple, and as a result, many of these mistakes can be easily avoided or corrected with fair warning.

Mistakes that will be discussed

1. Neglecting soil nutrients
2. Growing crops too densely / not thinning
3. Under-sowing seeds
4. Lack of crop diversity

1) Neglecting soil nutrients:

As touched on previously in Lesson 2, "Basic tools needed for urban farming", soil or non-soil growing medium nutrition balance can be a fatal mistake for beginners.

Using the tools mentioned in Lesson 2 (NPK test kit, pH test kit, brix refractometer, liquid fish) will help diagnose and improve soil nutrition issues.

Regarding specifically hydroponics and aquaponics, pay special attention to the nutrient balance in the water. On the most basic level, plants may grow with just water, but will have low brix levels and not be very "nutritious food".

2) Growing crops too densely / not thinning: Growing crops too densely will result in smaller average crop size. Even "smaller" plants like leafy greens will need space to grow. Spacing varies for each plant.

On a related note, "thinning" refers to selectively pruning your plants after they have started to develop and grow past the seedling stage (as a rule of thumb, a couple inches in height).

If you don't remove the smaller sprouts on your plants, they will sap nutrients and resources from the main plant, restricting growth. The good news?

Pruned sprouts are still edible!

3) Under-sowing seeds: Sowing seeds refers to the act of initially planting of the seeds prior to plant growth. Seeds will

commonly be planted in seedling trays and eventually transplanted to a larger growing container.

The mistake many beginners make is planting too few seeds. Germination rate, defined as the amount of seeds that develop into seedlings, is only about 40-80% for most crops you will grow.

For this reason, if you plant 1 or 2 seeds per slot in a growing tray, you will be improperly utilizing your space.

Planting seeds liberally can be corrected down the line by pruning the weaker plants that are competing for nutrients with your most promising crops.

4) Lack of crop diversity: As 35-year soil nutrition expert Graeme Sait, CEO and Founder of Nutritech Solutions, stated in an interview with [urbanvine.co](http://urbanvine.co):

"nature was never about monoculture, nature was about biodiversity, and so when we do the urban agriculture model we want to have all of that biodiversity present. "

If you think about it, throughout the history of plant growth before commercial agriculture, different types of crops always grew among each other as opposed to the current "monoculture" model.

As it turns out, this is a useful tactic to fight pests and disease in your urban farming project.

This strategy, referred to as "crop-pairing" or "interplanting", is a common tactic used by expert gardeners and urban farmers alike, but is often less known by beginners.

Examples of crop pairings:

- Lettuce + Chive for preventing aphids (a common type of pest)
- most crops + oregano - deters most common pest types
- rosemary or sage + carrots - deters carrot fly

## **In Closing**

We've just covered a few of the main mistakes we have seen based off conversations with thousands of our community members.

There are literally hundreds of mistakes urban farming beginners may encounter due to the sheer amount of crops and growing systems available.

If you are having problems that we have not discussed in this e-book, feel free to reach out ([patrick@urbanvine.co](mailto:patrick@urbanvine.co)).

Next up, Lesson 4, the basics of indoor farming and grow lights.



## Lesson 4

### The basics of indoor farming & grow lights

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#### **Getting Started with indoor farming and grow lights**

The biggest component of indoor farming, compared to say, rooftop urban farming, or any other outdoor urban gardening, is light.

For best results, indoor urban farming will always require supplemental light (if growing near a window).

Alternatively, grow lights are oftentimes part of a stand alone system that does not rely on outside light.

Due to the importance of grow lights in urban farming, we will spend the majority of this chapter discussing:

1) grow lights: the basic types, and what you need to know before buying grow lights

2) other aspects of indoor urban farming beginners should know about

First, we'll start with background on grow lights and the different types, and then discuss what to consider when purchasing grow lights.

### **The basics of grow lights**

There are 3 categories of grow lights commonly used for indoor urban farming.

These are Fluorescent lights (also known as CFL or fluorescent tubes), high pressure sodium (HPS) and metal halide (collectively referred to as HID or high intensity discharge lights), and light emitting diodes (LED).

Before discussing each type, we will get into why you need grow lights. Why grow lights are necessary:

Plant's grow via the process of photosynthesis, which requires light. But not just any light...

Light absorption in plants occurs due to a compound found in all plants: chlorophyll, specifically chlorophyll-a and chlorophyll-b, which absorb the red and blue light spectra.

Why don't plants absorb all light?

The first plants ever grew in the ocean millions of years ago, and red blue light penetrates underwater effectively.

How is this related to urban farming?

If a plant is receiving proper light from the red and blue light spectra, it will grow, just like with sunlight.

The following lighting types we will discuss in detail may not seem as powerful as sunlight or may not "look" like sunlight, but they will get the job done.

### **Types of grow lights**

Fluorescent lights will commonly be used for growing vegetables and herbs indoors. There are two main types of fluorescent bulbs:

1) fluorescent tubes: come in a variety of sizes T5, T8, T12, more efficient and longer lasting than incandescent bulbs but not as intense as HPS lighting

(discussed later). Another advantage of fluorescent tubes is that they are relatively thin and can fit well into small spaces.

2) Compact Fluorescent Lights (CFLs): Fluorescent compact lights are overtaking use of traditional incandescent bulbs for all lighting use cases (not just for urban farming).

This change is mainly due to the superior efficiency of CFL over incandescent and advances in technology for mass producing CFL's over the past several decades. (CFL technology is over 100 years old but at first was too expensive to produce at scale).

Details to know about CFLs:

- emit large amounts of light in blue and red spectra in most models
- use 20% - 30% of the energy of traditional incandescent
- 8x -16x lifespan of incandescent
- energy efficiency rating of 7-15%
- available at major hardware stores, cheapest light investment of all 3 major types

### **Next up, HPS (high pressure sodium lighting)**

Background: High pressure sodium lights (HPS) are a category of lights growing in popularity and overtaking fluorescent use, especially by more experienced and commercial growers.

Origin: The technology originated nearly 75 years ago

Tips and details for HPS:

- there are, in fact, LPS lights (low pressure sodium) on the market, but they are not great options for growing indoors (mainly due to improper yellow spectra that they emit)
- HPS will generally require a greater distance from plants. This is because they generate considerable amounts of heat and are more powerful bulbs.

- HPS will almost always require significant investment to set up, the system needed to manage heat and ventilation requires extra complications in the HPS setup process.

Suggestion: We would not suggest HPS lighting for beginners. With high set up costs and more complications than other options, the upside of this higher power lighting is not likely to be worth it for you.

## 2) HPS (High Pressure Sodium Lighting)

Origin: The first LEDs were developed in the early 1900's, however categories of red and blue spectra emitting LEDs suitable for urban farming and gardening indoors were not widely in use prior to the 2000s.

Details to know for LED indoor urban growing:

- LED's are by far the most efficient of all three major types: they regularly have light efficiency above 20% (CFL's are usually about 1/2 as efficient). Recent LED models have had over 60% light efficiency.
- light is much more focused. the result is that LED lights can be placed farther from plants and light doesn't quickly lose focus with distance
- zero or near-zero heat production by LED lights
- specific wavelengths can be targeted within color spectra, resulting in customized "plant therapy" lighting that can even improve lighting over sunlight. light emitting diode (LED)

## **Downsides of LED grow lights:**

- Protection often necessary for eyes when urban growing. Light can be harmful to human eyes
- Prices can be much higher than CFL
- Efficiency can sometimes best be captured at scale only. To elaborate, red-blue LED bulbs found in large retail stores will a) likely not be the optimum power amount for growing (too low) and  
b) will not be provided at a scale to allow energy savings to make economic sense
- For urban farming for profit, be sure to purchase a larger LED system online, you will realize ROI on the system much more quickly.

With all this in mind, we will now discuss what you should think about before buying a grow light. light emitting diode (LED)

## **What to think about before buying grow lights**

In this guide we will cover 3 core criteria to think about before buying grow lights:

1. space available
2. budget
3. safety

For a more in depth and exhaustive article on buying grow lights, see:

[urbanvine.co/blog/11-core-guidelines-urban-farmers-must-know-before-buying-grow-lights](http://urbanvine.co/blog/11-core-guidelines-urban-farmers-must-know-before-buying-grow-lights)

## **1) Space Available**

One of the most common questions beginning urban farmers ask involves managing limited space when starting an urban farming project.

If you don't have the space to operate a certain type of grow light, you won't be able to use it.

The reality is that different grow light types will require different amounts of spacing in between the bulbs and fixture and the plants.

If your plants are too close to the lighting, they will at the very least have lower yield and may even literally be burned.

When space is efficiently used with grow lights, vertical farming stacks can also be feasible by creating multiple layers of plant beds and grow lights.

Do get an approximate idea of the space you will need vertically, see the tables below for LED (light emitting diode) and HPS (high pressure sodium) lighting.

At the end of the day, the spacing necessary will have a lot to do with the strength of the light - the stronger the light, the more space needed is a fair rule of thumb for urban farming beginners who don't want to over-complicate planning.

## 2) Budget

One of the most important metrics to consider when buying your first grow light is the price of the grow light.

The good news for grow lights is this: there are a lot of options at all price points.

\$: CFL bulbs: can be found on amazon for less than 10 USD

\$\$: T5, T8, T12 fluorescent: good value for less than 100 USD. A 4 tube T5 grow light system can generate multiple hundreds of dollars worth of produce

in a year (1-2 year payback period with all other costs factored in besides lighting).

\$\$\$: LED and High Pressure Sodium (small sizes): most LED solutions will be on the pricier side relative to fluorescent, if you are going to spend on

LED's, your best option is to invest in a light from a well established LED vendor (full explanation in the next section "Vendor Quality")

\$\$\$\$: Most heavy duty commercial style systems will involve high pressure sodium/metal halide (collectively referred to as HID or high intensity discharge) and high priced options are increasingly now appearing for LED systems. These systems will range in the thousands of dollars (USD) and will often be part of larger systems involving grow tents, grow "boxes", air filters, fans, controlled environment features, etc.

### 3) Safety

Two key areas to evaluate with grow light safety are 1) how fragile the light is, and 2) the materials that are present in the light itself.

In both of these categories, LEDs have a clear advantage. For household growing projects where pets or children may be disturbing the lights, LEDs are much less likely to break when knocked down or jostled, due to the small size of the diodes and the way they are situated in the fixture.

Other lighting systems like fluorescent tubes and HPS lighting can be very fragile and will shatter or even explode if they are knocked over with enough force.

Additionally, mercury is present in fluorescent lighting while it is not present in the majority of available LED systems, if there is a broken bulb this is another safety hazard to consider, especially with children, pets, or any type of foot traffic in your growing area.

One extra consideration: HPS, Metal Halide, and even Fluorescent bulbs give off a significant amount of heat. If you are not sure you have the proper counteractive measures to mitigate this heat, not only will your plants suffer, but you may be creating a fire hazard.

#### **Other accessories commonly used in indoor lighting**

Below we've attached a list of other accessories you may want to look into specifically for indoor urban farming:

**ballast/fixture:** grow light systems require an electrical component called a ballast to regulate the power supply in the grow light. if you are buying just a bulb, of course you will also need a ballast. this is a necessary component for lights. ballasts can be purchased independently from grow lights but grow lights can also have the ballasts incorporated into unit.

grow tents: grow tents are another feature mainly seen paired with more expensive grow light systems. Tip: It's worth noting that many of the benefits of a grow tent that help create a more controlled growing environment can be replicated cheaply DIY (not all the benefits).

hydroponic pump: if you are going to be trying out a growing project using water as your growing medium, you will need a pump to help circulate water throughout your system. Nutrient solutions in the water will need to be recycled regularly, and this will impossible without a pump. Pumps can be found on Amazon for less than 20\$ USD.

Note we are omitting tools previously discussed in the guide like fans, spray systems, fertilizer types, etc. For more information see Lessons 2 & 3.

## **In Closing**

Grow lights are one of the most important aspects in indoor farming.

The lesson you should take away from this chapter is that if you have really good lighting, many of your other urban farming mistakes won't hurt you as much.

The 3 "pillars" of indoor agriculture to think about are:

- 1) expert lighting (discussed in this lesson)
- 2) Controlled environment (a more advanced topic, discussed briefly in this lesson, we will also cover in Lesson 7: Vertical and Rooftop Farming)
- 3) proper spacing (discussed in Lesson 3)



## **Lesson 5: The basics of soil-less growing mediums**

### **Getting Started**

Not all growing methods involve soil. By the end of this article, you will understand the basics of "soil-less" growing mediums and why soilless growing mediums are used.

### **Why Soil-less growing Mediums?**

Soil-less growing mediums for urban or small scale agriculture have a couple specific advantages over growing with just soil, as well as some downsides.

For the sake of thoroughness, we will cover both:

1. Modular: soilless growing in many cases can be more easily scaled. One example of this is vertical farming, where growing areas are vertically stacked on top of one another in multiple levels.

This modularity is often more difficult with traditional soil growing. If you have a certain plot of land, it may be extremely difficult (or even impossible) to expand this area without purchasing additional land (potentially expensive /hassle) or disrupting your surrounding environment.

2. Ideal for small spaces: many Urban Vine subscribers mention they have extremely small spaces to start their urban farms. Just as soilless growing can scale up in stacks, it can also scale down in size to fit the smallest of spaces, even inside consumer urban farming products like those produced by companies like Replantable ([www.replantable.com](http://www.replantable.com))

3. Water efficiency: In conventional soil, as pointed out by Powerhouse Hydroponics, much of the water absorbed into the soil does not directly benefit the plant. In other words, there is a loss of efficiency. Many soil-less

growing systems have been proven to use water more efficiently than soil.

#### Disadvantages of Soil-less growing

1. Taste Differences...? Many experts will claim that the regardless of how your crops "measure" nutritionally, the best tasting crops will be soil-grown, every single time.

2. Increased likelihood of drying out: soil-less grown plants do have a higher likelihood of drying out overly quickly, which could lead to problems with your plants.

3. Not ideal for large growing containers: soil-less growing tends to work best in small containers and trays

### **The 3 Basic Types of Soil-less growing**

Hydroponics uses water as the basic medium in which the plants are grown. Compounds like coconut husk or growrock will complete the medium (growing a plant just in water is possible but will usually have downsides long-term such as low nutritional content).

Aquaponics is similar to hydroponics, the most recognizable difference is the presence of fish in the growing system. The waste of the fish helps complete a cycle of nutrient production in the system and will lead to higher quality crop output and healthier plants.

Aeroponics involves the growing of crops with air as the primary medium. Water is still sprayed or misted onto the plant roots suspended in air. Aeroponics is not a viable method of production at scale.

### **Lesson 5: Soil-less growing: Takeaways and conclusion**

Keep in mind that these alternative growing styles are the topics of books themselves, this lesson was intended to give a general

overview of what's out there. That being said, here are some takeaways from the lesson:

- There are both disadvantages and advantages to soilless growing mediums
- Advantages include: modularity, good for small spaces, water efficiency
- Disadvantages include: potential compromise of taste, risk of drying out quickly, and less ideal for large growing containers (if not broken up into many small units)
- Hydroponics, Aquaponics, and Aeroponics are the three primary soil-less growing mediums to remember.

Next up, Lesson 6, selling to restaurants as an urban farmer & urban farming unit economics.



## Lesson 6

### Selling to restaurants as an urban farmer & urban farming unit economics

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#### **Lesson 6: Selling & Unit Economics**

##### **Selling to restaurants as an urban farmer & urban farming unit economics**

Many people are interested in selling the crops generated from their urban farms. The good news is, many restaurants are interested!

To cover this topic, we will break this lesson down into the following sub-sections:

- Tips on selling crops to restaurants as a beginner
- Increasing the value of your produce
- Discussion of Unit Economics and ROI

First up, tips for selling to restaurants.

Selling to restaurants as an urban farming beginner

## **Lesson 6: Selling & Unit Economics**

In order to get a better perspective on this subject, we interviewed professional vertical farmer Eric Amyot of [Modularfarms.co](http://Modularfarms.co) (also quoted in Lesson 1).

He points out the following tips for selling into restaurants:

- Start with one restaurant, and start with a simple conversation, what is the chef at the restaurant looking for as far as new and local ingredients? What are they not happy with as far as quality goes with current vendors?

Here are some other insights:

"One thing I would caution people upon is a lot of people like to do arm-chair research, I do most of my research sitting at my desk, seeing what's in the market, seeing what's happening, but until you actually get out there and learn the market a little bit, and that doesn't mean months and months of research it just means going to the farmer's market, going to the grocery store, and picking up that bunch of parsley or that head of lettuce and seeing what the cost is, or not the cost, but the retail value of that food, talking to the grocery manager if possible and asking them what type of volume they require, if they have any pains or issues with the food that they grow."

- Eric Amyot, [Modularfarms.co](http://Modularfarms.co) on selling urban farming crops

## **Increasing the value of your Produce**

- Remember that the "commodity pricing" in the crop market is not the same as the price that you can sell at the restaurant level
- Creating a "brand story" can allow you to charge 2-4x prices
- Growing niche crops or trending crops that have not caught the attention of large market commercial growers (Eric suggests edible flowers, kale, and ice plant as lucrative opportunities).

More from Eric:

"there are lot of other things that are really hot on the market right now, such as edible flowers, edible orchids is an example of a huge value that actually rivals cannabis believe it or not, and it's a crop that can be grown, it takes a little more dedication and education than just growing a head of lettuce, nonetheless, it's an example of things (that may generate ROI)."

- Eric Amyot, Modularfarms.co on increasing crop value

## **Discussion of Unit Economics and ROI**

Lesson 6: Selling & Unit Economics

"If you're addressing the market properly and you're starting on a small scale, as small as 200 or 400 square feet in a containerized farming system or even in your, I don't want to

say home because I don't people to think that they can just grow a commercial outfit out of their home, you can but it requires a lot of consideration for zoning and health and safety etc, but the opportunity to receive an ROI within 3 years is certainly realistic"

- Eric Amyot, Modularfarms.co on ROI and the size needed to sell

- The average T5 / T8 4 bulb lighting fixture will be able to generate approximately 100-250\$ of leafy greens in a single year.

- The cost of this type of system is approximately 200\$ in the first year. In this example, you could expect a pay off period within 2 years.

- In the example above, lighting and power will account for at least 50% of your annual costs.

- Viewing lighting from a unit economic expense is also helpful: for both LED and fluorescent T5 lights, target 20-30 cents (USD) per square inch of lighting coverage. (Example: 89\$ 2 foot 4 tube T5 Fluorescent lighting system covering 304 sq inches = \$.29 cents per square inch of coverage)

## **Finishing Up**

### Lesson 6: Selling & Unit Economics

There are certainly opportunities to not only start an urban farming project, but also to start an urban farming business.

To summarize a couple of the topics we covered in this lesson:

- there are opportunities for niche crops like edible flowers, for example, to sell to restaurants and other customers. These crops are not significantly harder to grow than the basics, and will tend to fetch a high price.
- having a brand or story around your product can increase its market value to customers, especially in the restaurant industry. If done effectively, you can leverage your brand story as the "local food hero" to markup 2-4x
- Plan to have at least 200 sq feet operating if you plan to turn a significant profit selling your produce. Expect a pay back period of 1-3 years.

To see the full interview with Eric, see:

**<http://www.urbanvine.co/blog/7-essential-vertical-farming-beginner-tips-with-eric-amyot-of-modularfarmsco-interview>**

Up next, Lesson 7, an introduction to vertical farming and rooftop farming.



# Lesson 7

## The basics vertical farming and rooftop farming

[www.urbanvine.co](http://www.urbanvine.co)

### **Lesson 7 - The basics vertical farming and rooftop farming**

#### **Getting started**

In this section we will cover basic aspects of vertical and rooftop farming.

Namely:

1) Vertical farming:

- History of Vertical Farming

- Pros and Cons of Vertical Farming
- 4 Step Process to How Vertical Farming Works

## 2) Why Rooftop Farming?

- Rainwater Retention
- Expansion Space
- Decreased likelihood of pests and interference
- Air Flow Benefits
- Access to Sunlight

## **History of Vertical Farming**

Vertical farming is most generally defined as the process of scaling the growing area of produce or other crops vertically into the air in "stacks" as opposed to spanning outward as in a traditional farming model.

Vertical farming often but not always uses technology to aid the growing process, for example common elements include:

- humidity control
- temperature control

- artificial lighting (mixes of artificial and natural light can be used)
- control / monitoring of nutrients and fertilizer

The modern concept was popularized in the 1990s by Dickson Despommier, a professor of ecology at Columbia University in NYC. According to urban farming legend, Despommier challenged his students to implement a plan as an assignment.

The plan?

To produce food for all of Manhattan's millions of residents using only urban rooftop agriculture.

When the most optimistic design provided produce for only 2% of Manhattan's population, Prof. Despommier suggested the idea that would lead to the modern concept of vertical farming:

Integrating urban agriculture with not just city rooftops, but also all of the floors of skyscraper style buildings. This concept could also be copied in independent vertical farming "towers".

Despite the creation of the vertical farming concept nearly 20 years ago, the term has (oddly) only become popular on the internet (as evidenced by Google search volume) over the past 5-8 years

## **Pros and Cons of Vertical Farming**

Cons:

- form over function: there are many critics of the Despommier vertical farming school of thought, for example, critic Stan Cox, a senior scientist at The Land Institute in Salina, Kansas and author of *Any Way You Slice It: The Past, Present, and Future of Rationing* has gone on record periodically since 2010 denouncing vertical farming (most recently in a February 2016 article in [Treehugger.com](http://Treehugger.com) titled "Vertical Farms: Wrong on So Many Levels").

Cox stated in a 2010 article titled "Vertical Farms aren't going to solve our food problems":

“Although the concept has provided opportunities for architecture students and others to create innovative, sometimes beautiful building designs, it holds little practical potential for providing food.”

- too expensive to operate from a financial perspective: from a unit-economics perspective, the profitability of vertical farming has been questioned (electricity usage, water usage, infrastructure cost). For this reason, community vertical farming has been supported over commercial vertical farming.

- too expensive to operate from a resource perspective (energy): a structure hundreds of feet tall would have issues with light pollution from the artificial lighting used in vertical farming and such a structure would require a lot of water to operate at peak performance (producing significant non-potable water waste).

Pros:

- reduction of "food miles": with massive local production capability, and the urbanization of the world population, large scale vertical farming construction would reduce the average travel distance of food (some produce you buy at the store regularly travels thousands of miles from harvest to plate)
- reduction of stress on traditional farmland: overuse of traditional farmland is damaging to future production capability and expansion of farmland when current areas are not producing enough crop output leads to other negative effects like extinction of native species and environmental pollution.

### **How Vertical Farming Works: A 4 Step process**

Four key areas to analyze the function of vertical farming are:

- (1) physical layout
- (2) lighting
- (3) growing medium
- (4) sustainability features

We can use the following example and break down the key characteristics and their function:

- (1) The primary goal of vertical farming is to maximize the output efficiency per square meter / foot, resulting in a "stacked" tower like structure

(2) often a combination of grow lights and natural light will be used, technologies like rotating beds can increase lighting efficiency and natural light exposure

(3) growing medium can be hydroponic, aquaponic, or even aeroponic (no soil or other medium). Non soil mediums like coconut husks or peat moss are often used.

(4) Sustainability features that offset the energy costs of the farm may include: rainwater collection tanks, wind turbines, multipurpose spaces in the structure not used for cultivation. Up next, rooftop urban farming.

Rooftop urban farming is a style that has numerous unique features compared to indoor growing or ground level urban gardening outdoors.

In this section we will detail these differences so that you can evaluate this as an option compared to say, indoor urban farming with grow lights.

Topics we will discuss:

- Rainwater Retention
- Expansion Space
- Decreased likelihood of pests and interference
- Air Flow Benefits
- Access to Sunlight

## **Rainwater Retention**

Depending on the type of growing medium you are using, agricultural units on urban roofs can retain up to 90% of rainwater which can in turn increase production and growth without constant manual watering or time consuming set up of self watering systems.

Depending on your location and the type of crop you are growing on your roof, this water access and retention capability may be a huge advantage for your crop growth.

## **Potential for Expansion Space**

Rooftops can be ideal for urban agriculture due to their space potential. According to American Rivers, there is over 4.85 trillion sq ft of roof space in areas with populations above 50,000 people in the United States alone, and currently less than .1% is utilized, despite over 25% growth year over year for urban agriculture on rooftops since 2010.

One special note to keep in mind before starting your rooftop urban farming project: Green Roofs for Healthy Cities suggests that the majority (perhaps as high as 95%) of current roofs are strong enough to support a full scale urban farm with all of the necessary growing medium layers (image below).

## **Pest and Human Interference**

Since the beginning of agriculture, pests have been a continual and evolving challenge for growers.

Pests \*will\* still be a risk on rooftops (rodents, birds, common insects) however, rooftop plants will be inaccessible by larger urban animals like rabbits or even deer. Additionally, rooftops will be less susceptible to disruption from human traffic.

As far as limiting insects with your urban rooftop crops, the first place to look for a solution may be bolstering the health of your soil or growing medium.

### Air Flow Benefits

Urban and greenhouse farming research from the University of Massachusetts at Amherst points out that maintaining horizontal air flow in greenhouses with the use of fans is important for improving quality of the products grown in the greenhouse.

Depending on the geographical location of outdoor urban rooftop farms, natural air flow conditions may provide similar benefits to crop production that fans would provide in a greenhouse. According the UMass research,

"During daylight hours, photosynthesis depletes the carbon dioxide that is in the boundary layer of air next to the leaf. Moving air will replace this depleted air with fresh air having a higher carbon dioxide content".

### **Access to Sunlight**

One key advantage of rooftop growing is access to sunlight. On the street level or indoors, light can be a serious issue and deficiency for urban crops.

For these reasons, urban rooftops may be the best place to start with an urban farm, as plant's will have the maximum possible access to natural sunlight, and this will directly increase yield.

And that's not all: because of the warmth provided by this extra sunlight exposure, rooftop urban farms will often have a "season extension" effect, meaning you can start growing slightly earlier in the spring and grow slightly longer at the end of autumn.

### **Bonus: Potential Effect of Urban Noise On Plant Growth**

Botanical studies from as early as 1962, have shown that ambient sound can have a positive effect on the production of agriculture. In fact, the difference in plant health between those grown with sound and those grown without sound has in some instances not even been close, with plants cultivated in the presence of ambient sound having growth acceleration in excess of 20% and increased biomass of 78%.

But how much more sound is present on an urban rooftop than a rural plot of farmland? According to Engineering Toolbox, the level of audible sound in rural wilderness areas tends to average to about 30-40 dBA whereas average sound levels in urban areas will usually approximately 85-90 dBA .

In Closing

Vertical farming in the commercial sense will typically be a large business venture with significant investment required (in the millions of dollars).

However, the basic concept of "vertical growing" can be replicated by beginners on a small scale.

As an example, check out how vertical grow towers are being used for urban farming at [www.zipgrow.ca](http://www.zipgrow.ca). This type of system can also be created DIY.

As for rooftop farming, if you have the space available, it can be a very viable option for a large portion of the year.

However, in some of the largest urban centers, space may be at a premium, even on rooftops.

Remember that if you are growing indoors on a windowsill, you may still want to invest in some supplemental grow lighting.

At the end of the day, the goal of this chapter is to let you know about these other options, so that you can help make the best choice for your own situation.

Next up, we will take a bit of a detour to the topic of permaculture (Lesson 8).



## Lesson 8

### What are the basics of permaculture?

[www.urbanvine.co](http://www.urbanvine.co)

#### Lesson 8

#### **What are the basics of permaculture?**

##### **A Brief History on Permaculture**

The term "permaculture originated nearly 50 years ago in Australia, and is a shortened version of "permanent agriculture".

The key to permaculture lies in its name: the core objective is to design an agricultural system that can sustain itself on an ongoing basis with little to no maintenance while meeting the local needs of all inhabitants.

Simply stated, the goal is to recreate the interdependence of nature.

## **Basic Notes on Permaculture**

- Permaculture often extends beyond food production to other areas such as architecture and even can be viewed as a "lifestyle"
- The basic permaculture system is broken up into zones (Zone 0 (home) through Zone 5).
- although permaculture zones are represented in a dart board style format often, they don't necessarily need to form perfectly concentric circle areas as zones

As noted, the core tenet of permaculture is its zone system. Below are basic definitions of the zones.

**Zone 0:** Home

**Zone 1:** Compost, herbs, leafy greens, raised bed gardens (daily care required)

**Zone 2:** Tree Fruit, Orchards, Pollinators (Beehives, for example) (weekly care required)

**Zone 3:** Core crops (wheat, soy, etc) (weekly care required)

**Zone 4:** Semi-wilderness: timber, hunting areas, fishing

## **Zone 5: Wilderness**

Another important concept beyond the zone system in permaculture is the concept of canopies for growing crops.

7 crop canopies make up the "Food Forest" or "Forest Garden" in permaculture:

Fruit Trees, Small Fruit Tree or "understory", Shrub or Bush, Herbaceous, Root Vegetable, Soil Surface, and Vine Plants.

## **The Zone System: Further Definitions Explained**

- Guilds: In permaculture, guilds are groups of plants or even animals that have demonstrated a symbiotic relationship.
- An in depth book discussing crop pairing (can benefit both permaculture guild design and urban farming beginners): "Carrots Love Tomatoes", by Louise Roitte
- Agroforestry: the permaculture-inspired concept of mixing tree crops and pasture for animals in co-location to increase space efficiency
- Hugelkultur: compost of objects like fallen trees to create super high nutrient soil

## **Other terms and concepts:**

Permaculture is not directly related to urban farming, but does have applications in peri-urban farming, or the practice of urban farming in suburban areas surrounding urban centers.

The concept of co-existence and pairing of plants is also a beneficial concept for beginners to take note of.

Modeling parts of your urban farming systems using permaculture concepts will help create more unique and, in many cases, higher yielding system.

Up next, Lesson 9, Seed Basics.



## Lesson 9

# What are the basics of seeds for urban farming?

[www.urbanvine.co](http://www.urbanvine.co)

## Lesson 9

### **What are the basics of seeds for urban farming?**

#### **Getting Started**

In this section we will cover two primary areas:

- 1) types of seeds you should know about
- 2) how to start seedlings + materials necessary

First up, types of seeds you should know about:

#### **Types of Seeds you should know about**

As touched on earlier, seeds have different classifications. Although we won't expand on it in this article, the 3 main types to keep in mind are:

1. hybrid: cross bred by professionals for positive qualities, not the same as GMOs
2. heirloom: original, "preserved" varieties of cultivars, not bred and usually several decades old (or more), almost exclusively grown non-commercially but often offering superior taste
3. GMO: genetically modified seeds, the chromosomes of the seed are modified in scientific labs, evidence of health risks but allows for robust plants at the mega scale for some commercial growers

## **How to start seedlings**

Why it is necessary to "start seedlings"?

There are a couple reasons why starting seedlings in a small growing cube and transplanting to a larger container is beneficial for plants:

- 1) **Strengthens root system:** most plant roots benefit from the transplant, it almost serves as a strengthening mechanism for the growing roots of your plant
- 2) **Moisture:** when starting seeds in a large container, the seeds will be overwhelmed with moisture oftentimes, and the result will be rotten / weak roots.

3) **Strong foundation:** transplanting seedlings with developed roots allows you to plant deeper into the new container, this will provide a better foundation for the plant as it grows into full maturity and is harvest-ready.

### **Basic Steps For Starting Seedlings**

Following is a basic step by step process for starting seedlings. Refer to the next section "Materials Needed" for more details on materials referenced.

1) Fill seed-starting 6 cube containers with seedling mix: don't use potting soil, instead, try: peat moss, permiculite, perlite based seedling mixes

2) add warm water to seedling mix cubes.

3) plant seeds in each slot, plant the largest seeds in the packet without pushing to the seeds to any depth beyond a couple millimeters.

4) cover the tray with a plastic bag or cover. ensure there are some holes in the cover for ventilation

5) water seedlings delicately, think spray mister instead of directly watering. rather than watering on a time-based schedule, look at the dryness of the mix.

6) Try to find a natural source of bottom heat or use a heating pad. The best temperature to start seedlings is approximately 70 F / 23 C.

7) When you see the first hint of green, remove cover and place in direct light

8) When the seedlings start to develop multiple visible leaves, they will be just about ready to move to a larger container for growing.

9) This process can be similarly repeated for hydroponic growing, starting seedlings is not a process unique to conventional growing styles.

For more information on starting hydroponic seedlings, see:

<https://www.youtube.com/watch?v=LxF-fBNtaY0>

Next up, we will cover the materials needed to start seedlings.

### **Materials Needed For Starting Seedlings**

Here are some of the materials you will need to start seeds:

Seeds: can be purchased online. Some reliable sites are UFseeds.com, MVseeds.com, and seedsavers.org (for heirloom).

Heating Pad: there are two types of heating pads, one with alternating heating periods and the other with a one time heating period set using a timer. For a small project, either will work, heating pads with timers will be more expensive and are used more commonly by gardeners.

Lighting: a T5 fluorescent will be a good basic light to start with. For more information on indoor lighting, see Lesson 4.

Seed Starter Mix: Per vegetablegardener.com, "The medium that is used to germinate seeds is a soilless mix. It's usually peat moss, vermiculite, perlite, or coir depending on who makes it. In any case, the advantages are the same: good drainage, lightweight, and no surprise diseases"

Containers: a common format for seed starting trays is 6 units, these trays are available on Amazon and similar online sources for less than 10\$ and are reusable.

### **Seed Basics: Wrapping Up**

The information in this lesson should have introduced you to the very basics of seeds and starting seedlings.

The seed starting process is necessary to most urban farming growing projects, regardless of style of growing (hydroponic, conventional, etc) and with most types of crops. For this reason, it's a key topic to cover.

### **The End!**

Thanks for reading! We hope that you have learned a lot! If you are interested in more guides and information, checkout our guides at [www.urbanvine.co/store](http://www.urbanvine.co/store)