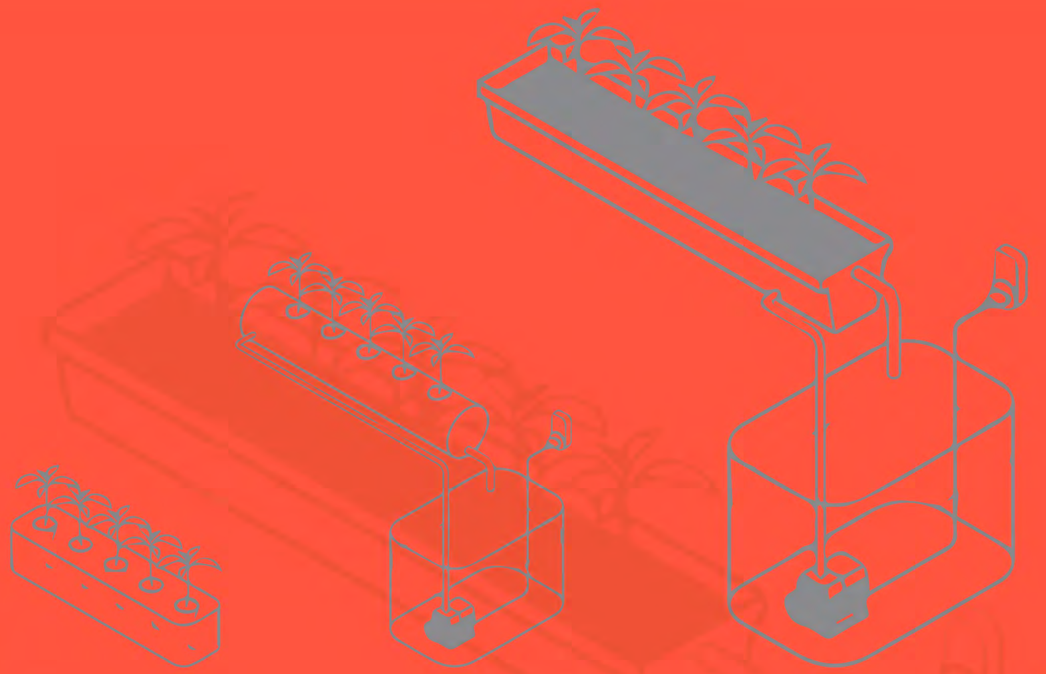
DIY **PACK**

SAEF Hydroponics

SKYFARMS

DIY PACK



INTRODUCTION

Facing the Challenges

01

FACING THE **CHALLENGES**

As we continue to face the challenges of climate change, volatile economies, global pandemics, and general uncertainty in the future, it is imperative for as many people as possible to get involved in food production, even if at a very small scale. Doing so helps us engage in the processes necessary to grow food and get a better understanding of what professional farmers go through to provide us with our essentials. Not only can this relieve some of the pressure on farmers to feed us all, but it can also reduce the negative impacts we have on traditional farm lands. Gardening can also serve as a fun and important learning opportunity for children and contribute to good physical and mental health in adults.

When it comes to horticulture, or high value (monetary and/or nutritional) plant crop production, not everyone lives in a perfect climate or has access to arable land with healthy soil. This is why hydroponics has been a game changer, allowing all, regardless of their location or situation, to simulate ideal soil conditions through various means. Moreover, growing in the home or a residential greenhouse can allow us to simulate ideal climates for our plants. Hydroponics comes in a variety of formats and relies on a number of different methodologies and physical systems to produce results. If you are familiar with hydroponics, then you have likely encountered the Nutrient Film Technique (NFT), the Deep Flow Technique (DFT), Aggregate Beds (commonly used in small scale aquaponics) and Aeroponics.

Until recently, Ebb-and-Flow (EF) systems had been used primarily as an irrigation system for ornamental plant nurseries' potted plants or seedling flats, as well as a drain to waste effluent collector for drip irrigated cannabis cultivation. It is essentially a system by which a leveled tray is fed with water or nutrient solution from below before it returns back to the reservoir by gravity. With this system, you are able to control how often the water floods, how deep, for how long, and this results in the ability to determine how much water will soak up into plant pots, depending on their size and content. Our research has shown, however, that EF has significant potential as a hydroponic system for the production of all manner of plant crops. Since EF systems make use of robust, simple, and reliable hardware, we have developed methods for its adaptation into a number of diverse applications by incorporating commonly used materials into its base hardware and experimenting with the variables that contribute to gardening and farming success in a wide variety of situations and locations at any scale and with any crop.

SAEF **HYDROPONICS**

02

SHALLOW AGGREGATE EBB-AND-FLOW AND SHALLOW AERO EBB-AND-FLOW (SAEF)

Our Shallow Aggregate Ebb-and-Flow and Shallow Aero Ebb-and-Flow (SAEF) methods make use of readily available, customizable, and scalable components to allow you to grow anything you like with maximal success. They incorporate the best aspects of all other hydroponic methods to ensure a user friendly experience and an optimal crop outcome. Like NFT, SAEF deploys a shallow film of water so that the system can be light weight, though it uses fewer parts and eliminates the risks of clogging while allowing the roots to breathe through pulse (periodic) irrigation. Like DFT, SAEF makes use of an insulated raft to seal the system, thereby insulating and reducing evaporative water loss while reducing the risk of oxygen depletion. Like Aggregate Beds, SAEF deploys high drainage and indefinitely reusable aggregates to ensure oxygen availability and reduce inputs. Like Aeroponics, SAEF allows for precision irrigation and control over all root zone parameters for maximal growth rates, just without the long parts lists and frequent maintenance, and with much more versatility. Suffice it to say, the ergonomics, efficiency, and adaptability of SAEF hydroponics are unmatched at this time.

GETTING **STARTED**

Let's go!

03

GETTING **STARTED**

For starters, you're going to need to decide what kind of space you are willing to devote to your new hydroponic garden, as well as whether you will be making use of natural lighting, artificial lighting, or both. A few basic kits are provided for you below so that you can get a feel for the parts involved in this approach. Please note that you can substitute any parts on these lists for any equivalents that will achieve the same ends, and you can often get much better prices on some of the components by shopping locally at the nearest gardening/hydroponics store. The prices and links provided are all based on online or hardware store inventory, and shipping is often factored into the price.

When using natural lighting, be aware of the lighting preferences and needs of whatever crop(s) you will be growing. Without getting into exact PPFD (photosynthetic photon flax densities) now, remember that nursery plants and microgreens do not need to receive direct sunlight, greens and cool weather vegetables can handle up to a few hours of direct sunlight per day, and most flowering and fruiting plants prefer or can tolerate as much direct sunlight as they can get.

After you decide what size of a garden you are willing to undertake and whether you want to deploy a single tier or multiple tiers (vertical farming), you will have to decide how it will be physically set up. A 2 ft x 2 ft tray can be mounted straight onto a 17 gallon tote while still allowing access to the hydroponic solution beneath. A single tray can also be mounted on a rack that can function to hold the reservoir off the ground and allow for lighting to be mounted onto the unit. Multi-tier systems must have artificial lighting sources, and there are countless LED luminaries to choose from at all price points and in multiple formats.

LIGHTING

"Be a light in this World"

04

LIGHTING

A basic mechanical/analog timer is appropriate for setting your lighting schedule, as there is no need for high precision in this area. Normally, it is best to choose a lighting schedule that coincides with when you are awake and active in your residence. The ideal day length depends on your crop(s) and goals, and you can research this and ask us for more information once you have chosen your crop(s). Your lighting needs will be determined by your system dimensions, number of tiers, placement, and the crop(s) you want to grow. Choose which luminaires to buy based on how much space they cover and the lighting intensity they deliver to your crop canopy under your specific conditions. Lighting is a complex and critical subject, so when in doubt start off with low cost lights that you can add to or upgrade later. Reach out with questions on lighting once you have advanced beyond the basics and we will help you figure out how to maximize your money in this area and achieve stellar results.

NURSERY

EF SYSTEM AS A PLANT NURSERY

05

NURSERY

To use your EF system as a plant nursery, you simply need to get a digital timer and program it to irrigate for as long as it takes to flood your tray to 1/4" to 1/2" deep (duration; usually 1 to 5 minutes) every 3 to 6 hours (frequency) during the lights on period, depending on your location's conditions. Irrigate more often if conditions are relatively hot and dry and less often if they are relatively cool and humid. Using 1020 flats, you can insert germination cubes such as polyphenolic foam, rockwool, or other materials and sow your seeds into these after thoroughly wetting and rinsing them. When your seedlings have 2 to 4 true leaves (in addition to the cotyledons) and roots emerging from the bottom of their cubes, then they are ready for transplanting into another system, pots, or an outdoor garden bed.

MICROGREENS

MICROGREENS PRODUCTION

06

EF SYSTEM FOR MICROGREENS PRODUCTION

To use your EF system for microgreens production, you simply need to get a digital timer and program it to irrigate for as long as it takes to flood your tray to 1/4" to 1/2" deep (duration; usually 1 to 5 minutes) every 3 to 6 hours (frequency) during the lights on period, depending on your location's conditions. Irrigate more often if conditions are relatively hot and dry and less often if they are relatively cool and humid. Using 1020 flats, you can insert germination mats made of felt, jute, hemp, bamboo, cotton etc. and sow your seeds onto these after thoroughly wetting them. Alternatively, you can use small plug trays or small pots filled with 1" to 2" of potting substrate (usually peat or coco coir plus perlite) to seed into. Keep the flats closed and dark for 1 to 3 days, depending on the crop species, before uncovering them and allowing the germinated seedlings to receive light. One to two weeks later, your microgreens will be ready to harvest and enjoy.

GREENS & HERBS

SAEF METHODS

07

TO GROW SALAD GREENS, VEGETABLES, AND GARDEN HERBS IN YOUR EF SYSTEM, YOU WILL BE USING ONE OF THE TWO SAEF METHODS:

Shallow Aggregate Ebb-and-Flow:

Best suited for small scale systems, this method involves filling your tray with a bed of aggregate, preferably expanded clay aggregate (ECA) to a depth of 1.5" and planting your seedlings into it as if it were a garden bed. To plant a seedling, dig a hole in the aggregate until you see the tray surface and place your germination cube onto the tray before burying it in aggregate with only the seedling emerging above the aggregate. Using a cycle timer, set the system to irrigate for as long as it takes the solution to cover the tray surface under the aggregate every 1 to 2 hours.

Shallow Aero Ebb-and-Flow:

Well suited to any scale, this method involved cutting a raft to fit your tray using whatever tools you prefer. Instead of floating on water, as in DFT, the SAEF raft will either be placed on the internal tray surface or wedged to sit ~1/2" over the tray surface. If your raft comes with planting holes, great, and if not, drill whatever holes you want out with an electric drill and a 1-1/2" hole saw. To plant a seedling, simply insert it into a hole in the raft. The seedling cube may be set onto the tray surface or can be set to hover slightly over it. Using a cycle timer, set the system to irrigate for as long as it takes the solution to cover the tray surface under the aggregate every 10 minutes to 1 hour.

FRUITING & FLOWERING CROPS

"Be a light in this World"

08

TO GROW FRUITING AND FLOWERING CROPS IN YOUR EF SYSTEM, YOU WILL BE USING ONE OF THE TWO SAEF METHODS:

Shallow Aggregate Ebb-and-Flow:

Fill your tray with a bed of aggregate, preferably expanded clay aggregate (ECA) to a depth of 4" to 6" and planting your seedlings into it as if it were a garden bed. To plant a seedling, dig a hole in the aggregate until you see a single layer of aggregate over the tray surface and place your germination cube onto this layer burying it in aggregate with only the seedling emerging above the aggregate. Using a cycle timer, set the system to irrigate for as long as it takes the solution to cover the tray surface under the aggregate every 1 to 4 hours.

An alternative to having an entire tray as an aggregate bed is to use containers or pots to individualize the bed for each plant, thereby allowing you to move, shuffle, and rotate individual plants without disturbing the rest. Square pots allow for maximum coverage and avoid letting light contact the tray surface.

Shallow Aero Ebb-and-Flow:

Cut a raft to fit your tray using whatever tools you prefer. The SAEF raft will be wedged to sit 1/2" to 1" over the tray surface. If you raft comes with planting holes, great, and if not, drill whatever holes you want out with an electric drill and a 1-1/2" hole saw. To plant a seedling, simply insert it into a hole in the raft. The seedling cube may be set onto the tray surface or can be set to hover slightly over it, using a net-pot if necessary. Using a cycle timer, set the system to irrigate for as long as it takes the solution to cover the tray surface under the aggregate every 15 minutes to 1.5 hours.

MAINTENANCE

Hydroponic Solution Maintenance

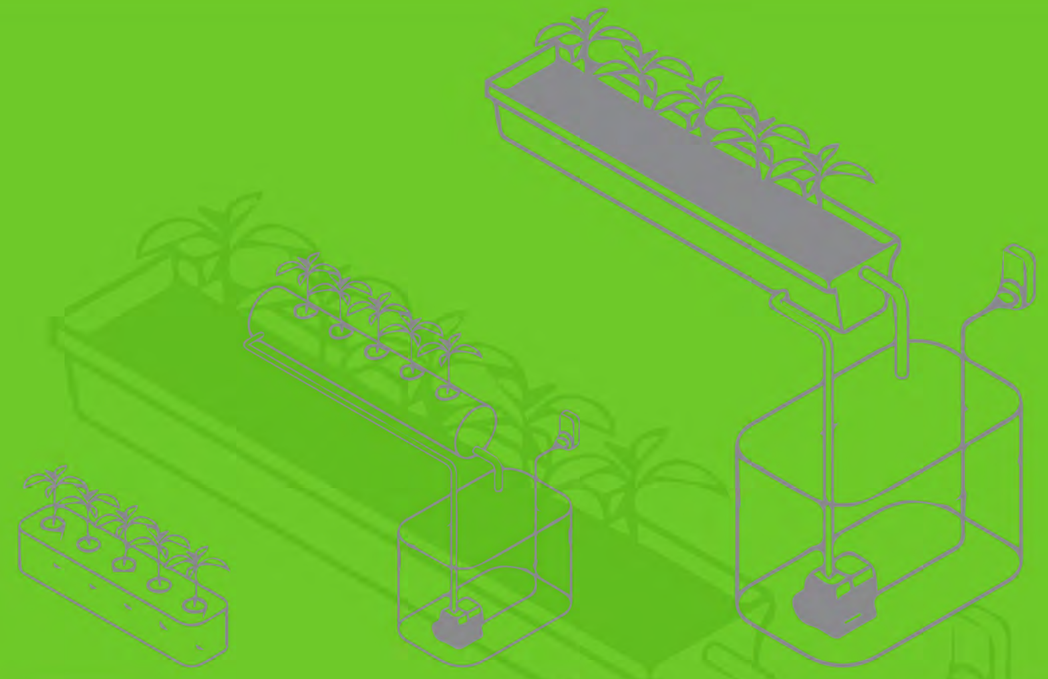
09

HYDROPONIC SOLUTION MAINTENANCE

Initially, once your system is fully assembled and before putting plants into it, fill your reservoir with cool tap water (typically pH 7 to 8.5). Add fertilizer (multi-part fertilizers are to be added in equal parts without allowing concentrated forms to mix) while stirring until your E.C. meter indicates you are at the proper concentration for your crop(s) in question. Next, measure pH and add acid or base as needed (slowly using a dropper) while stirring until the pH settled on your desired value, depending on your crop(s).

Daily, top off your reservoir with tap water, check and adjust E.C. by adding fertilizer if necessary, then check and adjust pH using acid or base as necessary. Be sure and completely change out your nutrient solution every two weeks at most to avoid deficiencies and salt build ups. As often as is practical (usually in between crop cycles), empty out your entire system, remove all debris and plant materials, and sterilize all surfaces (including the pump interior) using a 0.5% to 1% hydrogen peroxide solution.

DIY PACK



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