farming in *space*, farming ***anywhere***

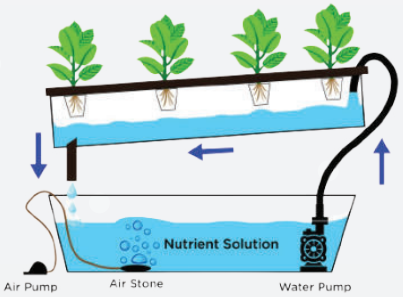
HYDROPONICALLY GROWN
Moonflower Farms

# INTRODUCTION TO HYDROPONICS

## FOR FUTURE SPACE SCIENTISTS

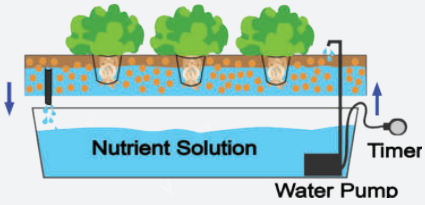
Designed by C4W RKX LLC

Hydroponics is the growing of plants without soil.  The name comes from the root words "Hydro", meaning water and "Ponos", meaning to work. Here are some examples of different types of hydroponics:



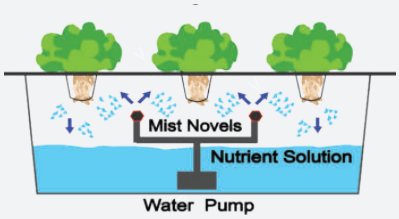

## NFT or Nutrient Film Technique

Plants are watered from the bottom with a thin film of nutrient rich water at their roots.



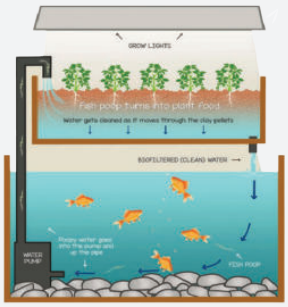

## Ebb and Flow

Plants are watered from the bottom by a system that floods plants from the bottom and then drains out on a timed cycle.



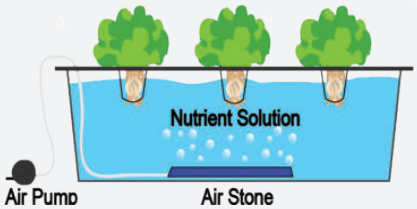

## Aeroponics

Plants and roots are suspended in air. The reservoir (with oxygenating air pump) has misters, which spray a fine spray over the plant roots on a timed schedule.



## Aquaponics

Plants are watered on a time schedule using waste water produced by fish.

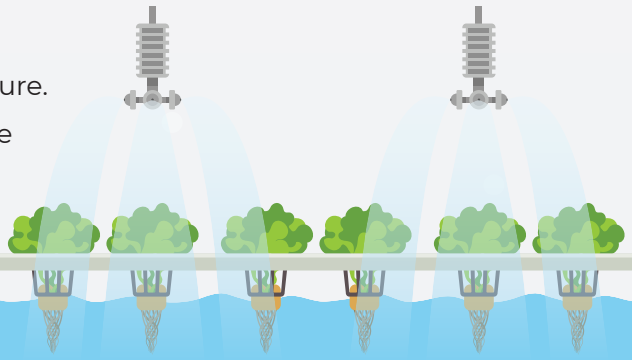



## Deep Water Culture

Plants are suspended over a nutrient reservoir using a net pot and growing media. The roots themselves are submerged in the reservoir, so they have a constant supply of water and nutrients.

# 5 HYDROPONIC FUN FACTS AND FIGURES

Hydroponics is a method of growing plants without soil. It is the fastest growing sector of agriculture, and it could very well dominate food production in the future. There are many advantages of hydroponics and here are 5 great reasons to start growing now....



## hy·dro·pon·ics

**Noun:** the science of growing or the production of plants in nutrient-rich solutions or moist inert material, instead of in soil.

**Latin:** words *"hydro"* meaning water, and *"ponos"* meaning labor.

**90%**
less water

farmers claim that some hydroponic crops use 90% less water than the same crops in traditional soil farming.

**10x**
of the space

you can plant 10 times the amount of crops in the same space as traditional soil farming.

**zero**
soil used

some crops grow twice as fast in hydroponic media (zero soil) due to getting correct amount of nutrients, water, and oxygen.

**0.0**
pesticides

hydroponic crops typically use 0 chemical herbicides and 0 chemical pesticides. This greatly lowers impact to our bodies and our environment.

**10x**

Hydroponically grown plants are 10 times less likely to contain pests or soil-borne diseases than field grown crops

# All plants need six essential items in order to thrive:

## Water

Plants need water to survive.  Plants have different watering needs but without water, they will die.


## Oxygen

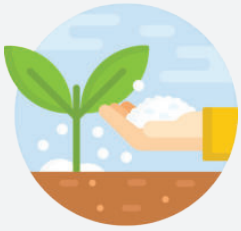
Plant roots need oxygen to survive.  Without oxygen at the roots, plants can develop root rot and can be attacked by pests.

## Grow Media

Plants can grow in most anything.  Plants can grow on walls, in glass, plastic, clay pebbles, soil, water, pumice, sand, and gravel. Roots just want to hold on to something.

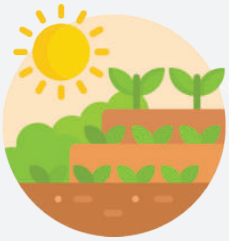
## Proper pH

Plants need the proper pH to take up nutrients and thrive. Most plants like a slightly acid pH of 5.5 to 6.5 to grow well.



## Nutrients

Plants need a variety of nutrients to grow well.  Plants need N, P, K or Nitrogen, Phosphorous, and Potassium along with micronutrients such as iron, calcium, magnesium, silicon, etc.



## Light

Plants use photosynthesis to make foods from carbon dioxide and water.  Sunlight or special LED grow lights can provide the energy that the plants need in order to do this.

# NASA and the Veggie Program

NASA is growing plants on the International Space Stations. Microgreens, herbs, lettuces, and root crops are being grown.

They will need fresh produce. They will also grow microgreens in space. Microgreens offer up to 40X more nutrition than their full grown plants. NASA estimates it would take 11 years to use 1 pound of microgreen seeds in space per astronaut.

Plants are good for our psychological well-being on Earth and in space. They are critical for keeping astronauts healthy on long-duration missions.

A lack of vitamin C was all it took to give sailors scurvy, and vitamin deficiencies can cause a number of health problems. Packing multi-vitamins will not be enough to keep astronauts healthy as they explore deep space. They will need fresh produce.

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https://www.agritecture.com/blog/2022/5/18/growing-microgreens-in-space-how-nasa-is- feeding-astronauts-using-vegbed-grow-mats

https://ntrs.nasa.gov/api/citations/20190033178/downloads/20190033178.pdf

# A brief history of Hydroponics

**600 B.C.**
The Hanging Garden of Babylons

**1000 A.C.**
The Floating Garden by the Aztects

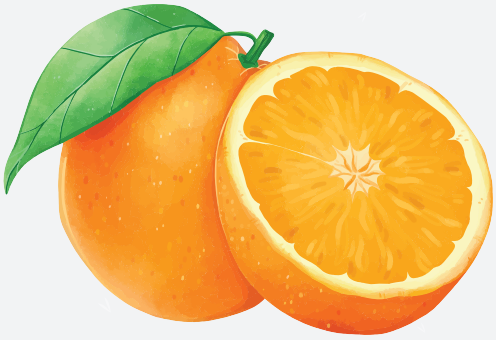
**LATE 1200s**
Marco Polo discovered floating gardens in China

**1699**
John Woodward discovered that plants derived minerals from soil mixed into water solutions

**1930s**
The word "Hydroponics" was termed by W.F. Gericke

**1940s • NOW**
Many types of Hydroponic were introduced. Hydroponics got recognized and has been used widely in commercial greenhouses as well as at home

Fresh produce travels over **1600 miles** on average to go from farm to table in the US.



Although organic produce leaves behind the genetic modification, antibiotics and the pesticides it also leaves behind almost 77% of it's Vitamin C contents before it ever hits the grocery store shelf. Locally grown is more important than ever.


https://medium.com/@evanfolds/the-history-of-hydroponics-99eb6628d205
https://cuesa.org/learn/how-far-does-your-food-travel-get-your-plate
https://g2lm.com/f/nutrition-loss-during-transport
https://onlinelibrary.wiley.com/doi/full/10.1002/fsn3.685

# Plant Journal

Write down your daily observations below :

| Day | Date | Time | Observation |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |

*Hint: You can trim micros as needed and they will regrow. After several trimmings you can plant roots in your garden and plant will grow!*

# ABOUT MOONFLOWER FARMS



*"Our Mission is to **accelerate** the growth of hyper **local farming** worldwide."*

## *Our Vision*

## PLANT **ECONOMIC SEED** OF DEVELOPMENT


Enabling one **self-sustaining** community at a time powered by **Moonflower Technology**

*Proceeds benefitting*

Children's Environmental Literacy Foundation

Designed by C4WORKX