



What is Hydroponics?

- Hydroponics is growing food without soil.
- We just have to give the plants the same conditions that soil would provide:
 - Water
 - Nutrients, including oxygen
 - Support
 - Good growing environment (temperature)

Why Grow Things Hydroponically?

Advantages

- Plants get what they need more easily so they grow faster.
- Plants need much smaller root systems so more energy goes into leaf and stem growth.
- With smaller roots, you can grow more plants in the same area. You can even stack them up.
- You can grow plants all year round – in cold climates or deserts.
- Hydroponics uses much less water than traditional gardening. (Water is captured and reused.)
- Automated systems make the work easier.

There Are Many Kinds of Hydroponic Systems

Wick Watering

Plants are supplied with nutrient solution by capillary (wicking) action so no energy or moving parts are needed.

Ebb and Flood Systems

This uses a pump on a timer to repeatedly flood the plant roots with nutrient solution.

Nutrient Film Technique NTF

A pump transports a nutrient solution on an inclined plane (in a tube), on which the plant roots lie. The roots are continuously watered in a thin “film” of nutrients.

Deep Water Culture DWC -

Well-rooted plants are placed in a net pot on a floating plate in the liquid reservoir, like a raft.

Drip Irrigation

Via a drip line, the nutrient solution is dripped onto the substrate around the plants.

Aeroponics

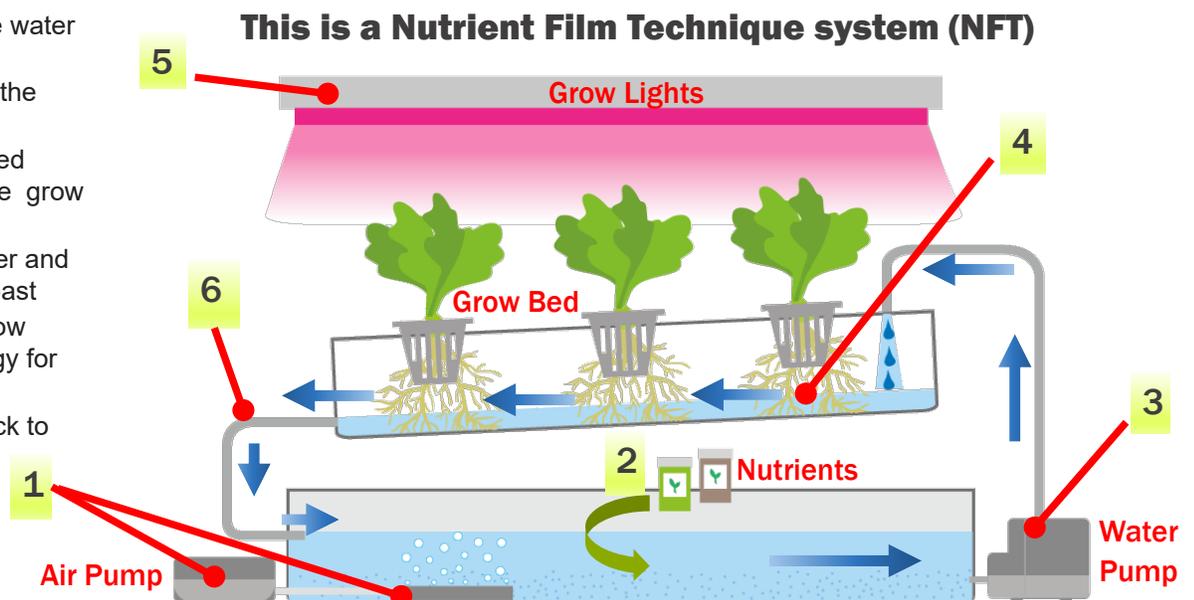
The roots of cuttings or plants do not hang in a liquid but in a mist of nutrient solution.

Aquaponics

Combines aquaculture (fish farming) and hydroponics (plant breeding), so the water with fish excrements are used as nutrients for the plants.

How do hydroponic systems work?

1. Oxygen is added to the water with an air pump
2. Nutrients are added to the reservoir
3. Nutrient water is pumped from the reservoir to the grow beds
4. Plant roots absorb water and nutrients as they flow past
5. High efficiency LED grow lights provide the energy for growth
6. Water is gravity fed back to the reservoir



What Can be Grown?

- Many kinds of plants can be grown hydroponically.
- Different systems have different capabilities.
 - Nutrient Film Technique Systems, for example, are most often used for growing leafy greens and herbs.
- Plants that do well in a hydroponic garden can include artichokes, beans, lettuce, spinach, tomatoes, cabbage, celery, beets, asparagus, broccoli, cauliflower, brussel sprouts, green beans, peppers, English cucumbers, marrows, peas, strawberries, blueberries and herbs
- Vegetables that grow beneath the soil, such as onions, leeks, carrots, parsnips, potatoes, yams and radishes will also grow hydroponically, but may require extra care.
- Some crops to avoid are corn, zucchini, summer squash, and vining plants. They can be grown in a hydroponic garden, but they are not space efficient and just not practical.

Grow Lights

Getting the Light Right

- Plants need light to survive
- They use light in photosynthesis to create the energy needed for growth and survival.
- In nature this light comes from the sun.
- Regular indoor lights don't have the correct type of light "spectrum" that plants need.
- Special LED growlights are usually used to provide the best wavelength of light.



Advantages of LED Growlights

- LED's use less electricity.
- They also burn with less heat so they can be placed closer to plants for maximum benefit.
- LED's last longer.
- LED's can be set up to provide different color light as needed.
- Light timers can be used: lights on for up to 16h per day.

Plant Nutrients

It is important to ensure the plants receive all of the nutrients they need for healthy growth. These are often available in pre-mixed powders that can be added to the water.

There are two basic kinds:

- Macro Nutrients – those needed in large amounts
 - From the Environment - Carbon, Hydrogen, Oxygen
 - From Fertilizer - Primary
 - Nitrogen - for vegetative leafy growth
 - Phosphorous - for root & flower formation
 - Potassium - for fruit development
 - From Fertilizer - Secondary
 - Calcium, Sulfur, Magnesium
- Micro Nutrients – those needed in small amounts
 - From Fertilizer - Iron, Boron, Chlorine, Copper, Manganese, Molybdenum, Nickel, Zinc

Close Monitoring is the Key

Things that may need to be watched and adjusted in many of the more complex hydroponic systems include:

- EC – electrical conductivity. This measures the amount of plant nutrients in the water.
- pH – “potential of hydrogen” measures the acidity of the water. This is important for plants to absorb nutrients.
- DO – dissolved oxygen. Plants need oxygen to survive
- Temperature – plants need a certain air and water temperature for best growth
- CO₂ - carbon dioxide – needed for plant growth

Some systems use a computer to monitor these and in some cases can automatically adjust them.

Regular Maintenance is Important

The work involved in maintaining a hydroponics unit depends on its complexity. Here are some of the tasks that may be involved:

GROWING

- Starting seeds
- Moving young seedling plants into the growbeds
- Harvesting + packaging + delivery / proper storage

MAINTAINING

- Fill the water reservoir + change out the old water every few weeks
- Ensure correct water flow and remove blockages in the plumbing
- Looking for pests + nutrient deficiencies

CLEANING

- Wear proper clothing
- Wash hands
- Inspect and clean pumps, filters, airstones, drip lines
- Clean plumbing fixtures, growbeds (remove algae, unwanted bacteria)
- Sanitize and clean the areas

For More Information

5 Ways to Start Hydroponic Gardening - The Spruce

<https://www.thespruce.com/beginners-guide-to-hydroponics-1939215>

How Hydroponics Works - How Stuff Works

<https://home.howstuffworks.com/lawn-garden/professional-landscaping/hydroponics.htm>

Various hydroponics systems - Hydroponic Urban Gardening

<https://www.hydroponic-urban-gardening.com/hydroponics-guide/various-hydroponics-systems/>

Video - Hydroponics: The Science of Growing Plants without Soil - Labroots

<https://www.labroots.com/trending/videos/10250/hydroponics-science-growing-plants-without-soil>

Video - The Science Behind Vertical Farming - Labroots

<https://www.labroots.com/trending/chemistry-and-physics/12038/science-vertical-farming>

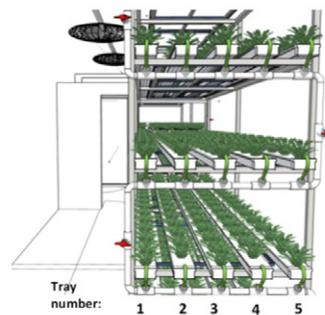
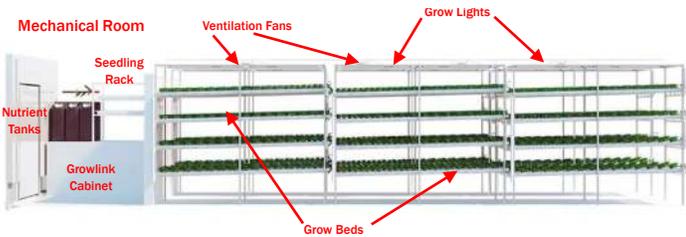


A Hydroponic Story

A Three Nations Energy project intends to reduce dependence on imported food and increase locally-grown food for the community of Fort Chipewyan in northern Alberta.

The first stage of this project is to set up a Growcer's state-of-the-art container farming system.

- It combines hydroponic technology with precision climate controls to enable the community to grow fresh produce year-round.
- This system uses a 'Sea-Can' Self-Contained Unit
- Fort Chipewyan will have the first Growcer unit connected directly to a food market.



Some Other Communities with Growcer Units



Yellowknife
run by local Co-Op



Kugluktuk
run by students and teachers from the local high school



Prince Rupert and Port Edward area operated by Gitmaxmak'ay Nisga'a Society community garden centre



And now, Fort Chipewyan!



Norway House Cree Nation operates their unit to supply the local Northern Store