Introduction to Hydroponics: Growing More in Less Space

UC Master Gardener
University of California
Agriculture & Natural Resources

The Mission of the UC Master Gardener Program is to extend research based knowledge and information on home horticulture, pest management, and sustainable landscape practices to the residents of California and be guided by our core values and strategic initiatives.

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State Evaluation

- You will receive an email survey from UCANR (University of California Agriculture and Natura Resources) in about 3 months from this talk.

- The short survey provides us the tools we need to grow and improve the quality of our program. We do not sell or share your contact info with anyone else.

- By answering the email survey, your help us demonstrate the impact of our classes and we will continue to receive funding from UCANR and other sources.

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Inspect your Citrus!

- Asian Citrus Psyllid (Insect)
- HLB (Disease)
- If your tree gets this disease it will die in 3-5 years
- There is no cure
- Inspect your trees for the insect and its nymphs shown on the right.
- If detected, spray your trees
- Do not treat trees when bees are active
- Control ants in your trees
- Visit CaliforniaCitrusThreat.org
- Visit ipm.ucanr.edu

New Invasive *Aedes* Mosquitoes

***Aedes aegypti* and *Aedes albopictus* are urban mosquitoes that feed on humans.**

- They are aggressive **day-biters** found both indoors & outdoors that spread diseases including Zika, Chikungunya, and Dengue.

Both *Aedes* species lay eggs in water holding containers as small as a bottle cap.

- Eggs can survive more than ***12 months* in dry conditions!**
- They detect where water has collected before and **lay eggs there to wait for water.**

Ways to prevent and control *Aedes* mosquitoes:

- **Eliminate standing water**: Regularly inspect for standing water and eliminate it.
- **Block yard drains**: Cover or block yard drains between May and October.
- **Replace landscape**: Replace your landscape with California native plants to keep mosquitoes away.
- **Scrub containers**: Scrub containers that have been left outside with warm soapy water and a brush before throwing them away or storing them in a dry place.
- For more information go to **Ventura County: Invasive Aedes Mosquito Information or the front page of our website**

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The Objectives of this Talk:

Discover the basics of hydroponic gardening – we'll talk about:

- Both commercially purchased and DIY hydroponic systems.
- How to set up and maintain a system to ensure success.
- Which plants thrive in soil-free environments.
- Along the way we'll talk about lessons learned from our own experience.

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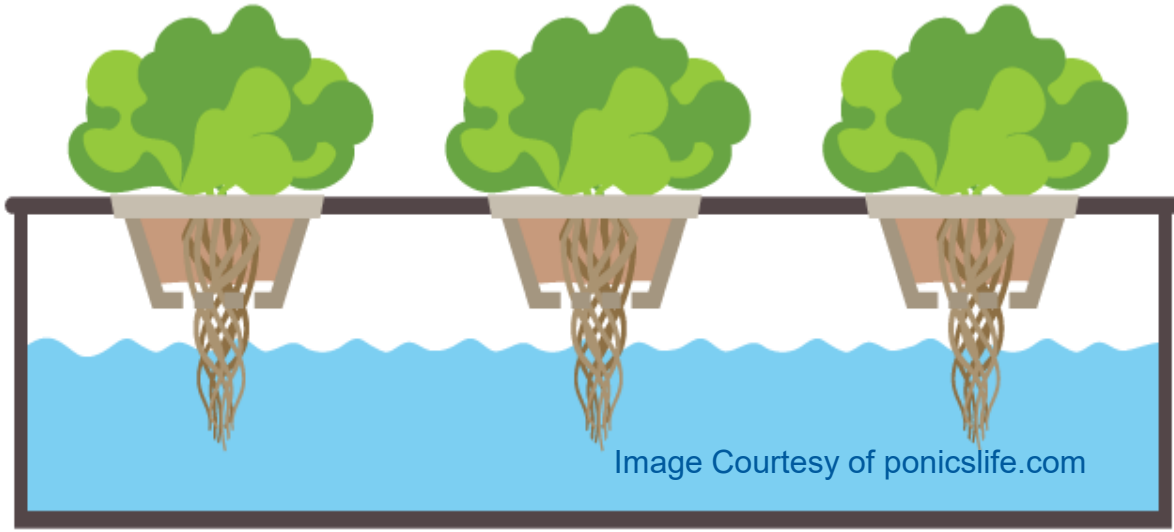
What is Hydroponic Gardening?

Hydroponics, derived from the Greek words "hydro" (water) and "ponics" (labor).

- Refers to the cultivation of plants in a water rather than in soil.
- Growing plants using a nutrient-rich water solution.
- With or without the use of an inert medium like sand, gravel, or perlite to support the roots.



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Why Choose Hydroponics?

- Hydroponics uses up to 90% less water than conventional growing methods!
- Hydroponics uses less space than traditional in ground and raised bed gardening.
- Hydroponic gardening can result in larger yields in less time.
- Pest pressure can be less problematic with hydroponic gardening.
- Because it's FUN!

Image Courtesy of extension.umn.edu

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How it Works?

- **Support -** Hydroponic systems provide structural support for the plants, allowing them to grow and develop without the need for soil.
- **Growing Media (Optional) –** Most systems use inert media to support the roots while they access the nutrient solution, while others suspend the roots directly in the solution.
- **Nutrient Solution –** Plants require specific nutrients for growth, which is dissolved in water and delivered to the roots.
- **Oxygenation -** Plant roots need oxygen to thrive, which is often delivered through aeration methods like air stones or pumps.
- **Light –**The sun provides light for growing outdoors and lights will be necessary for an indoor set up.

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Types of Hydroponic Systems - Wick

- **Wick System:** a wick draws nutrient-rich water from a reservoir to the roots.
- **Deep Water Culture (DWC):** Plants' roots are submerged in a nutrient solution, with aeration provided by an air stone.
- **Ebb and Flow:** The nutrient solution is periodically flooded and drained, providing the roots with water and nutrients.

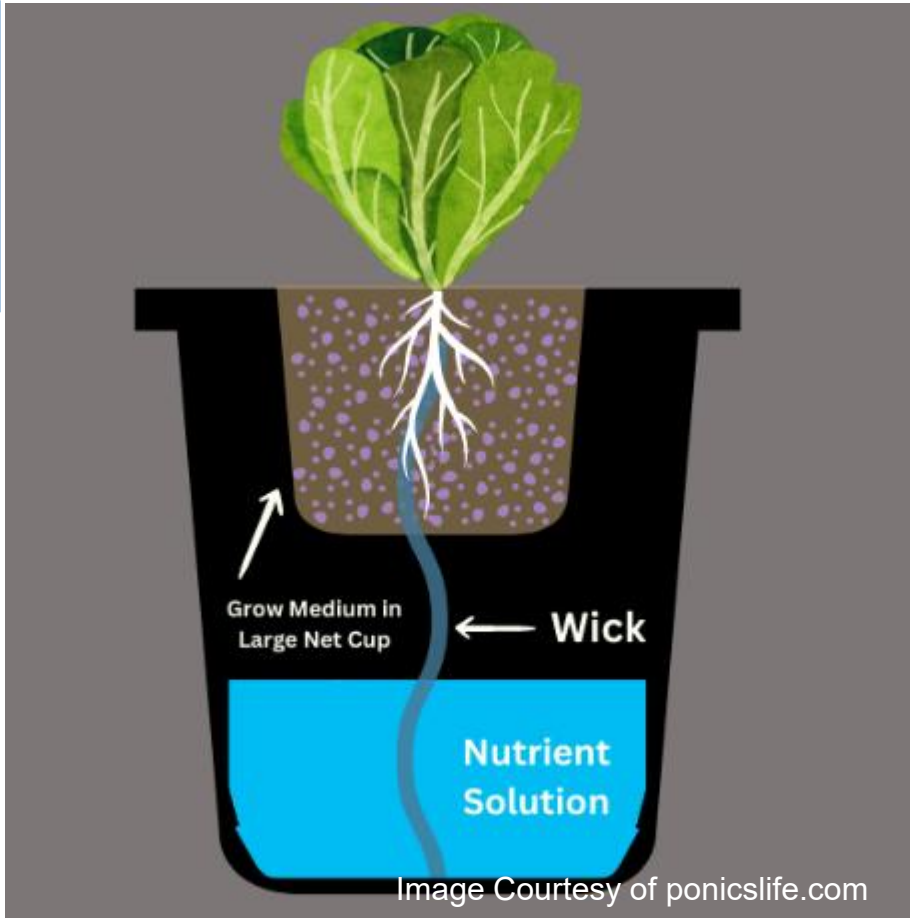

Image Courtesy of ponicslife.com

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Types of Hydroponic Systems –EBB and Flow

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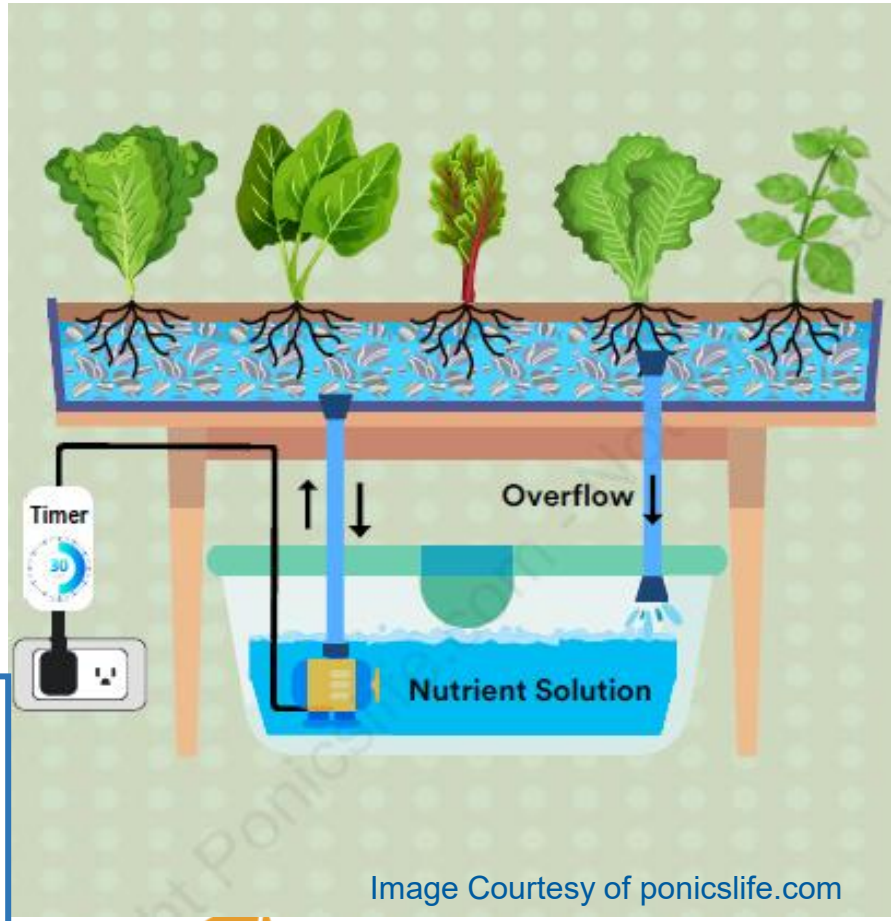

Image Courtesy of ponicslife.com

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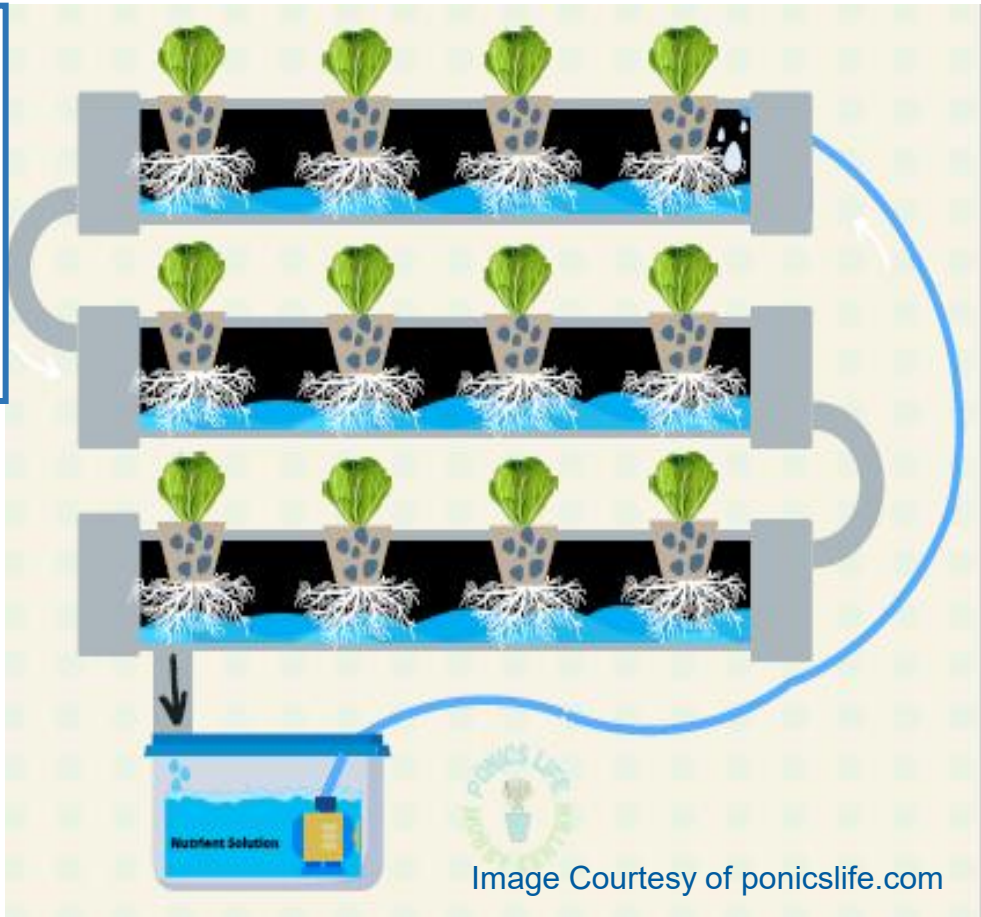
Types of Hydroponic Systems - NTF

- **Nutrient Film Technique (NFT):** Plants are grown in a tray with a thin film of nutrient solution flowing over the roots.
- **Drip:** Water is pumped to grow area and slowly dripped onto plants.
- **Aeroponics:** Plants' roots are suspended in the air and misted with a nutrient solution.



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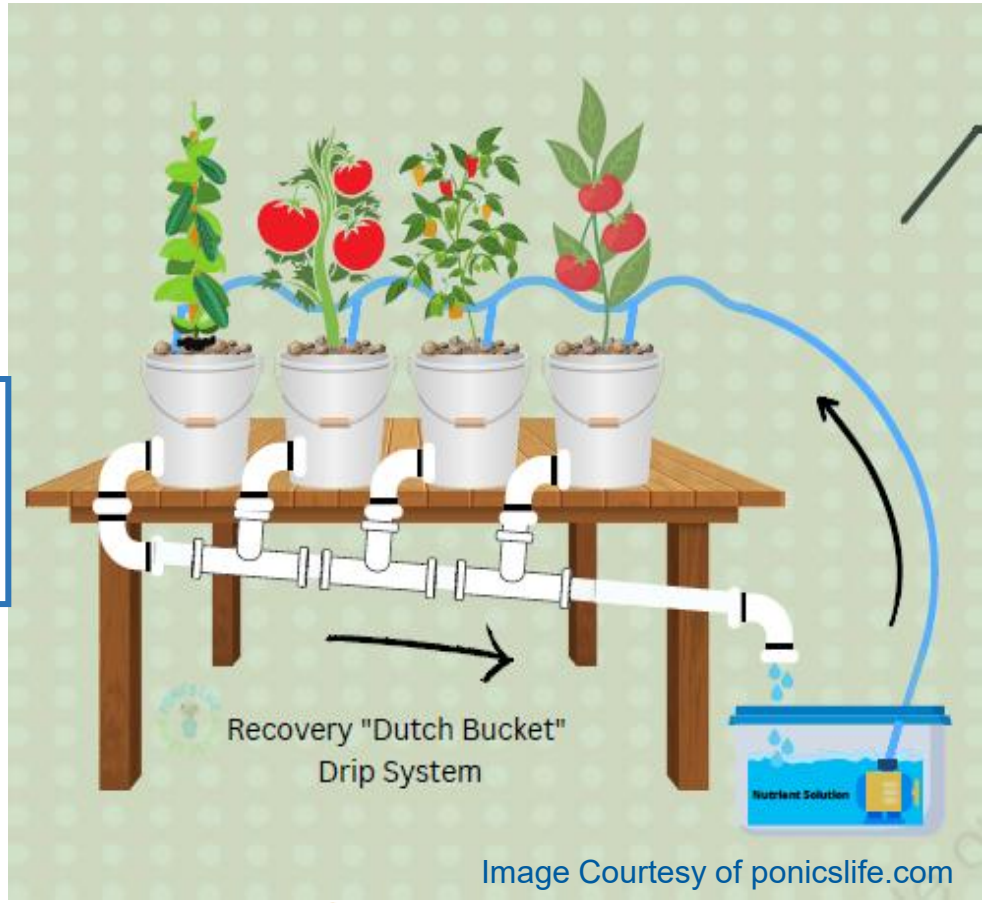

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Types of Hydroponic Systems - Aeroponics

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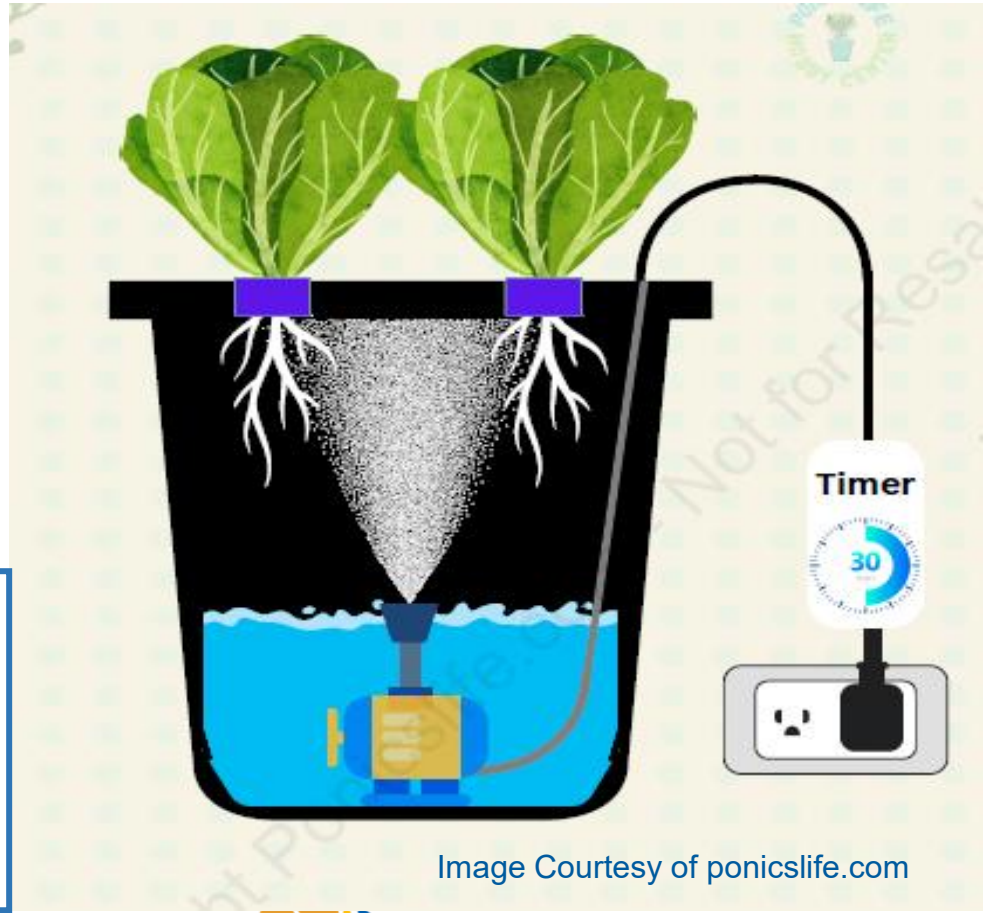

Image Courtesy of ponicslife.com

Types of Hydroponic Systems - Kratky

Kratky Method
a passive system, plants grow in a nutrient-rich solution, no pump needed, allowing plants to absorb water, oxygen, and nutrients as needed.

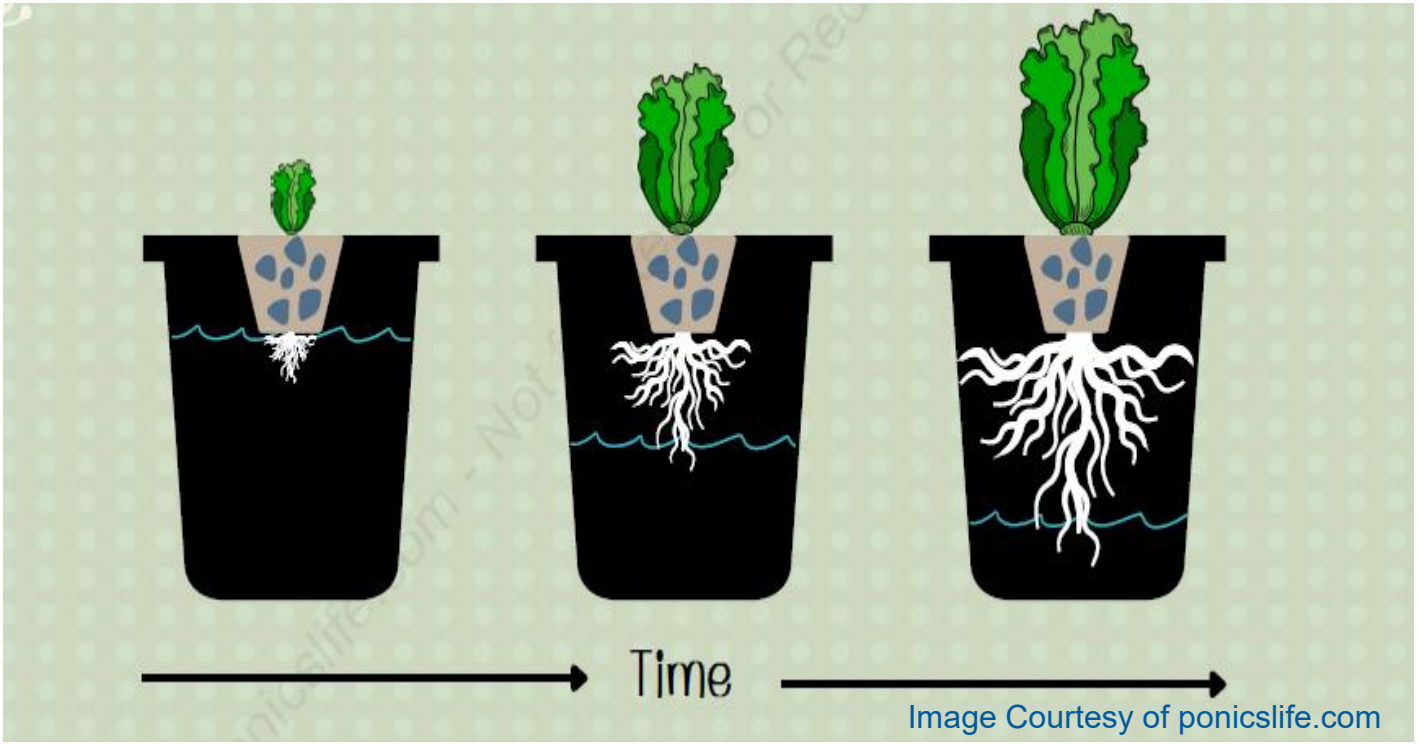

Image Courtesy of ponicslife.com

Tip: if growing indoors a light system will be required.

Combination of Systems

An example of this would be a Nutrient Film Technique (NFT) or an Ebb and Flow system that includes a wick to draw up nutrients until the plant has developed enough roots to reach the flow of water.


Image Courtesy of gardenandgreenhouse.net

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Essential Components – Net Pots

Containers - support plant roots, retain water for plants to feed and serve as the basis for your system.

- Net Pots – are plastic mesh containers to hold plants.
- Buckets – used as reservoirs or to hold plants.
- Storage Bins - used as reservoirs or to hold plants.
- 2L Bottles – or just about anything that will hold water and your plants.

Image Courtesy of growneer.com

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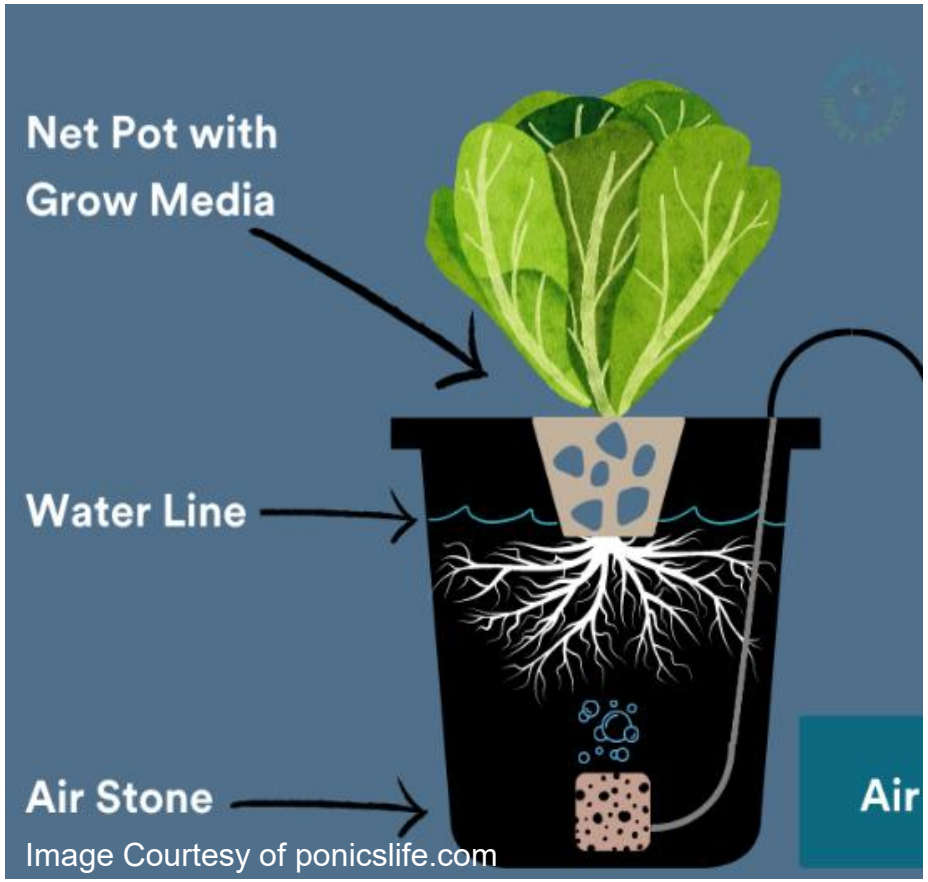

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Essential Components – Storage Bins

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- 2L Bottles – or just about anything that will hold water and your plants.

10-GALLON STORAGE BIN WITH LID

Image Courtesy saferbrand.com

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Essential Components – Recycle Bottles

Containers - support plant roots, retain water for plants to feed and serve as the basis for your system.

- Net Pots – are plastic mesh containers to hold plants.
- Buckets – used as reservoirs or to hold plants.
- Storage Bins - used as reservoirs or to hold plants.
- 2L or 1Gal Bottles – or just about anything that will hold water and your plants. Be sure to block the sun to prevent algae.

Image Courtesy of instructables.com

Essential Components – Growing Media

1. Rockwool (basaltic rock) and **2. Oasis Cube (**foam) - excellent water retention.

3. Expanded Clay – natural clay, porous structure.

4. Coco Coir (chips or fiber) **–** slow to break down and retains nutrient.

Image Courtesy of nosoilsolutions.com

5. Perlite (volcanic glass) and **6. Vermiculite** (mined mineral rock) - Best used together.

7. Rock/Gravel – cost effective but may heat in the sun and raise system temperature.

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Essential Components – Nutrients

- **Water-based solutions containing essential nutrients including macronutrients and micronutrients.**

Provides all the essential elements - nitrogen, phosphorus, potassium, calcium, magnesium, and trace elements.

- A well-balanced nutrient solution is crucial for maximizing plant growth, yield, and quality.

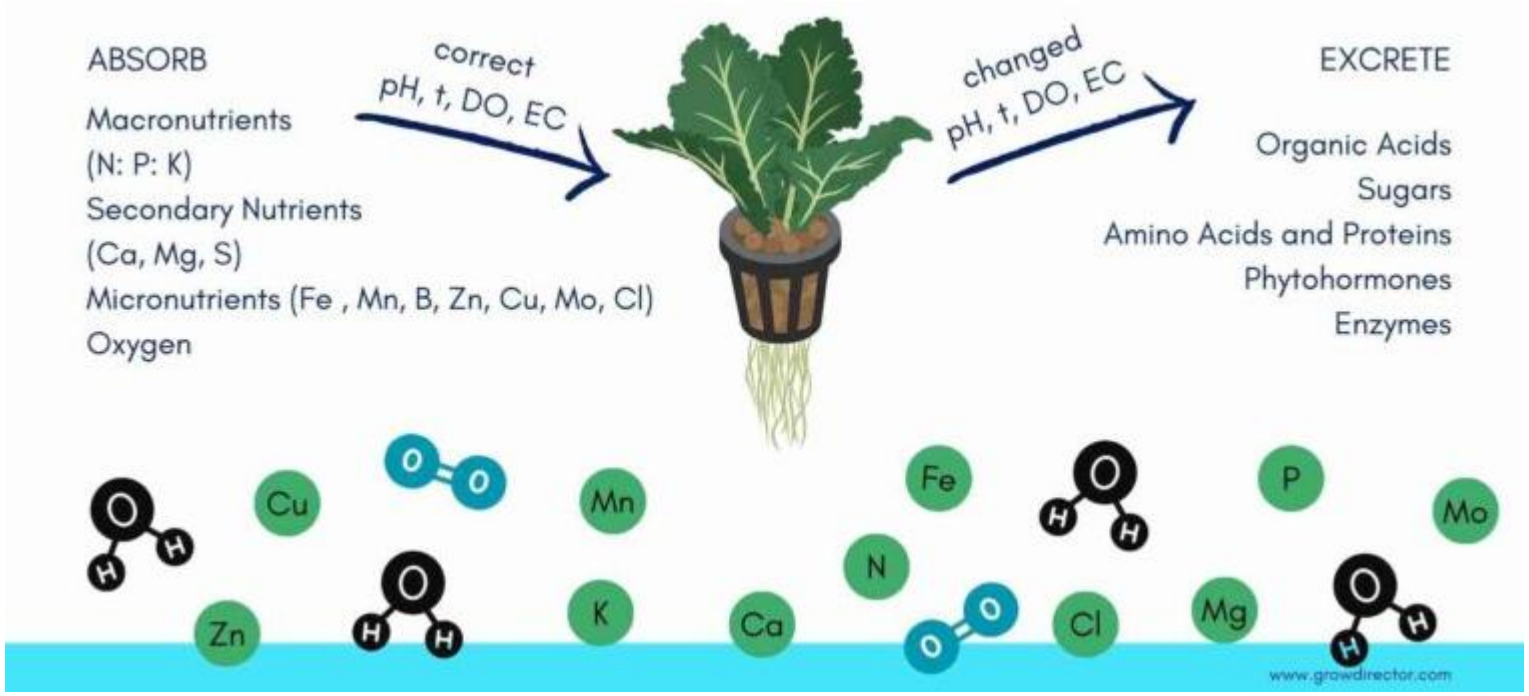

Image Courtesy of growdirector.com

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Other Essential Components

- **Water** – Ideally with a neutral pH (between 5.5 and 6.5) between 65°F and 75°F.
- **pH Testing Method** – and pH up and/or pH down solutions.
- **Aeration** – Some hydroponic systems need an air pump to ensure sufficient oxygen for the roots.
- **Timer** – if using an air pump.
- **Light** – Plants need light for photosynthesis, so you'll need natural light or grow lights (for indoor).
- **Electricity** – if using a pump or indoor grow light.
- **Plants** – can be herbs, vegetables, or flowers.

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What Should You Grow?

- Food your family likes to eat.
- Expensive food per pound.
- Hard to find specialty items.
- Plants that offer frequent harvests - lettuce or arugula.
- Fast growing crops – radishes or mustard greens.
- Plants with compact growth habits.
- Fruiting plants – peppers, tomatoes, or cucumbers.
- Plants with similar light, temperature, and nutrients needs.

Image Courtesy of countryliving.com

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Best Plants for Hydroponics

Leafy Greens

- Lettuce
- Spinach
- Kale
- Baby Bok Choi
- Green Onions

Herbs

- Basil
- Chives
- Cilantro
- Mint

Compact or Small Fruiting Plants

- Cherry Tomatoes
- Strawberries
- Radishes
- Cucumbers
- Peppers (small hot or sweet)
- Beans

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Plants to Avoid as a Beginner

- **Large Plants with Large Root Structures**
  - Melon
  - Squash
- **Large Root Vegetables**
  - Bulb Onions
  - Potatoes
- **Plants Requiring Special Care**
  - Blueberries

Harvesting and Replanting

Harvest

- Harvest frequently to promote vigorous growth
- Cut and come again works great for your greens
- Remove diseased and dying plants without delay

Replanting

- Replace with a new seedling
- Start seeds in the open spot

There is no need to do a complete reset of your entire unit.

Maintenance

- **Regular system checks**
  - Check for leaks
  - Check for backups and continuous water flow
  - Check pH
  - Check your pump
- **Routine Cleaning**
  - The water needs to be clear and clean
  - Replace water on a regular basis
  - Make sure your unit is clean

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Troubleshooting – Oh, No!

- **System -** power outage, system failure, leaks in system.
- **Nutrients** – wrong for plants, too strong, deficiencies.
- **Light/Air/Water** – too much or too little, no circulation, too warm/cool.
- **Algae growth** – light getting to nutrient solution and growing medium.
- **Plants** – root rot, powdery mildew, pests (aphids, thrips, fungus gnats, white flies, spider mites), small yields.
- **Keep a Journal/Log** – hydroponic gardening is very sensitive – documenting (writing notes and taking pictures) will help you remember the good and the bad.

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Conclusion and Questions…

- There are several different types of hydroponic systems – find one that fits your needs, time, space, and budget.
- Plant what you will eat (food) or enjoy (flowers).
- Keep a journal to record the successes and challenges.
- Make it a family affair – get everyone involved – and have fun!

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Resources

Links:

- Poniclife.com - best system for beginners
- Nosoilsolutions.com - hydro-systems - grow-medium
- proponics.co.uk - blogs - general-hydroponics common-problems
- Books:
- The Hydroponic Garden Secret – by Susan Patterson, ISBN 978-1-944462-15-4

Got Gardening Questions?

Contact the FREE

Master Gardener Help Desk

Email: **mgventura@ucanr.edu**

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For Upcoming Classes Go To [Ventura County Master Gardener Website]

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