

Hydroponics



FAIRBANKS
SOIL & WATER
CONSERVATION DISTRICT

Hydroponics

Hydroponics is a method of growing plants in water without soil.

The water must be enriched with nutrients and the plants need some type of inert medium to support the root system.

The essential ingredient is an oxygenated mineral-nutrient water solution that's circulated through plant roots.



Hydroponics works by providing a consistent complete nutrient mixture and water to the roots.



Large Scale Hydroponic Farming

Climate Controlled Agriculture

Large scale hydroponic farming is in use around the world to grow the produce that we eat.



Anchorage Greens



Chena Hot Springs Hydroponics

Small Scale Hydroponic Gardening

Small scale hydroponic gardens can provide folks with year-round food readily available in your home or classroom.



Hydroponic Grow Tower



Deep Water Culture Hydroponics

Advantages – Why Use Hydroponics?

Faster Growth

Plants get everything they need all the time, so they do not waste time or energy growing a lot of roots or searching for nutrients and can grow faster.



No Weeds/Reduced Pests

Since most pests live and breed in the soil, there's usually no need to use pesticides or other toxic pest control chemicals.



Faster Growth

More Harvest



February 4



February 17



February 24

Disadvantages

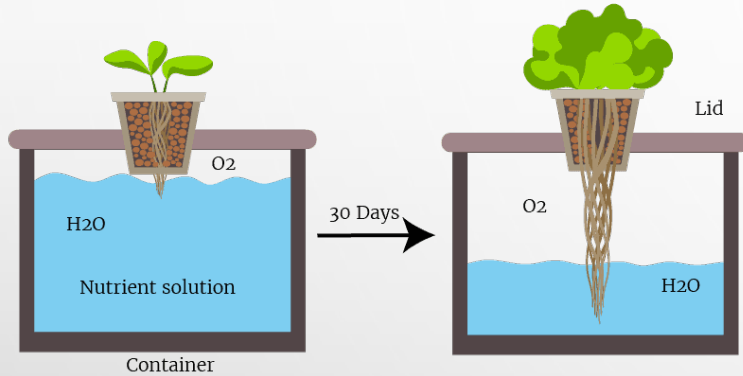
- Large systems can have high energy costs which can be prohibitive.
- Moisture from systems can cause damage to buildings. Fish tanks do this also. Mold, moisture spots, leaking systems onto floor.
- Specially formulated, soluble nutrients are needed in most systems.
- Pests and diseases can remain a big risk. Indoor plants can get aphids which transfer easily.
- Some water born diseases can spread rapidly in recirculation system if not monitored correctly.

Year-Round Harvest

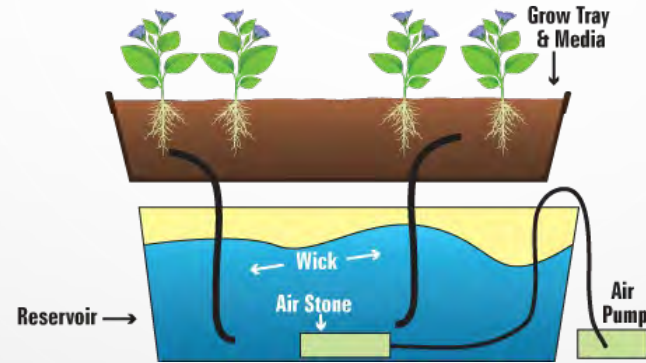


Types of Hydroponic Systems

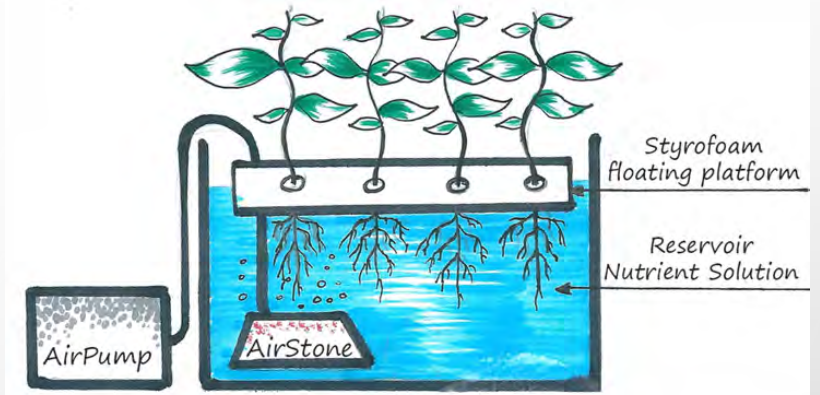
Kratky



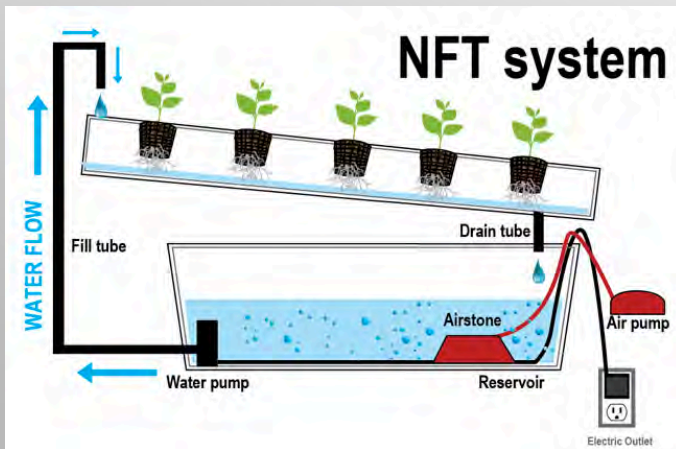
Wicking



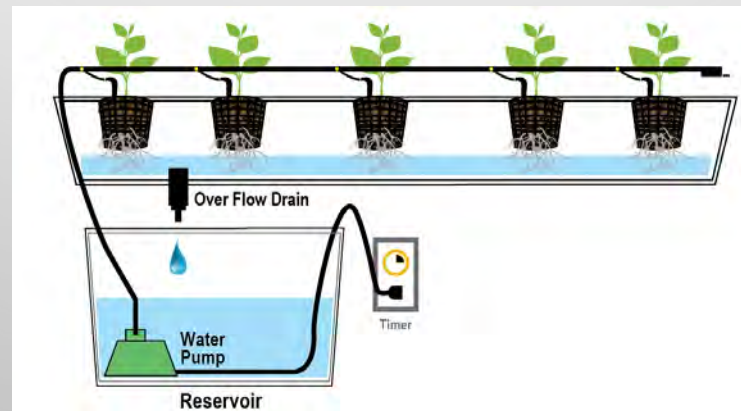
Deep Water Culture



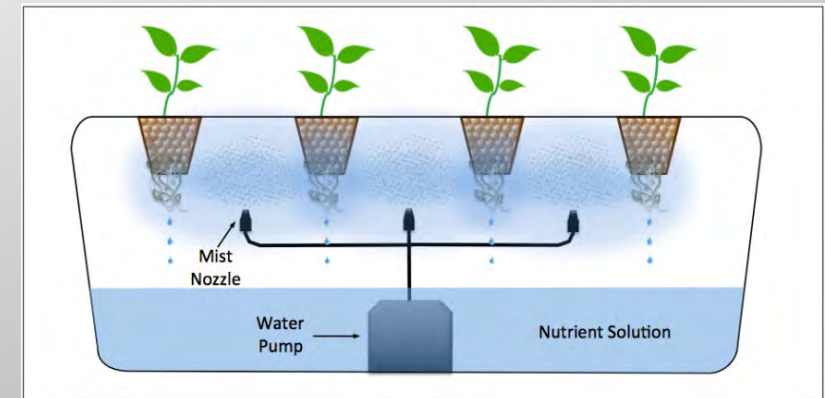
Nutrient Film Transfer – NFT



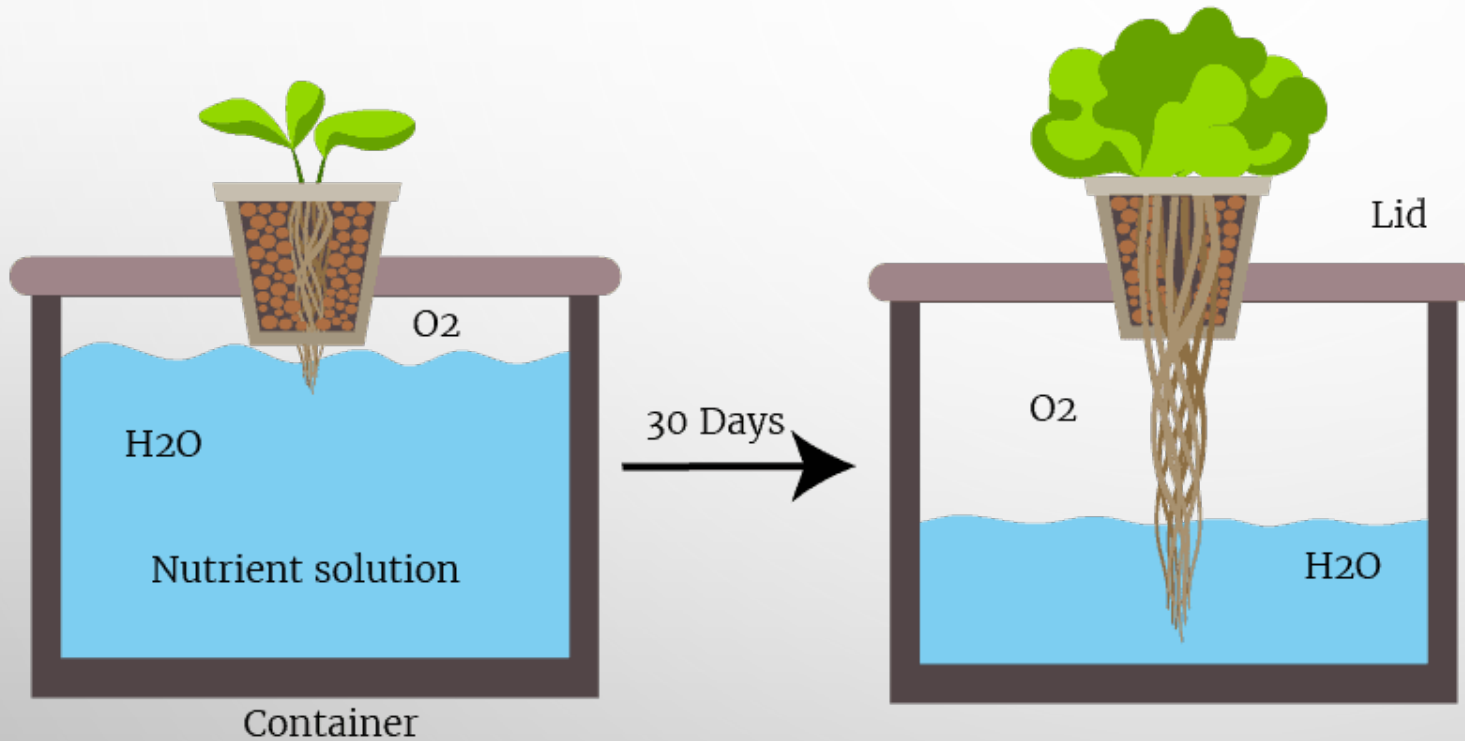
Continuous Drip



Aeroponic

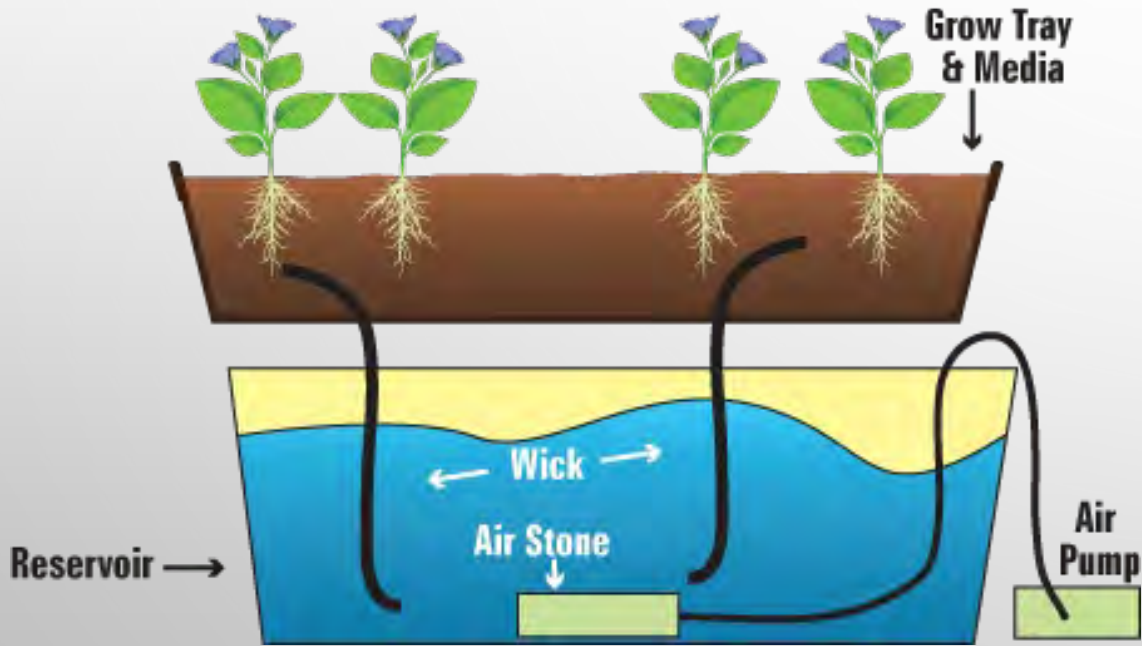


Kratky System

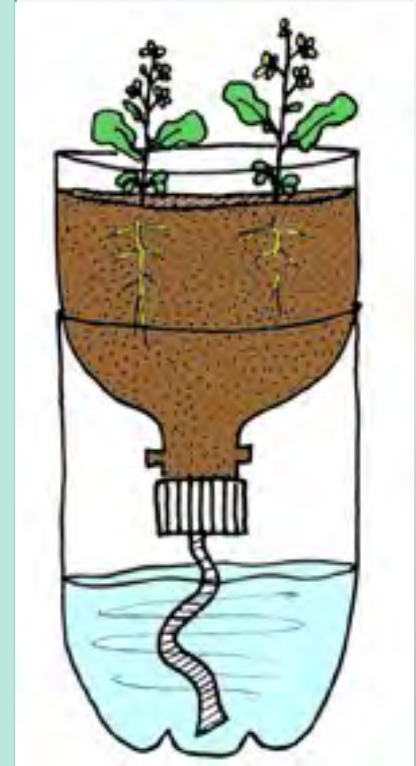


- Simple Passive System
- No Moving Parts
- No pump or moving water
- Nutrient Solution Delivered directly to roots

Passive Wick System

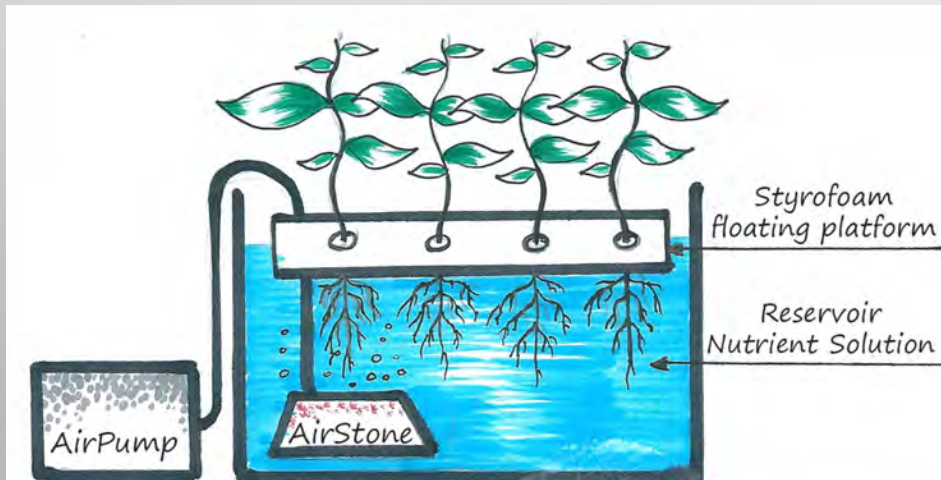


- Simple System
- No Moving Parts
- Nutrient Solution Delivered with a Wick
- Plants may use the water and nutrients faster than the wick can supply it.



Deep Water Culture Systems

- Plants grow on platform with roots suspended into solution
- Air bubbled into nutrient solution to provide oxygen for roots



Deep Water Culture in a Fish Tank



Deep Water Culture System In a Plastic Storage Tub



Deep Water Culture System in Sleds on a Metal Shelf



Foam and Net Pots

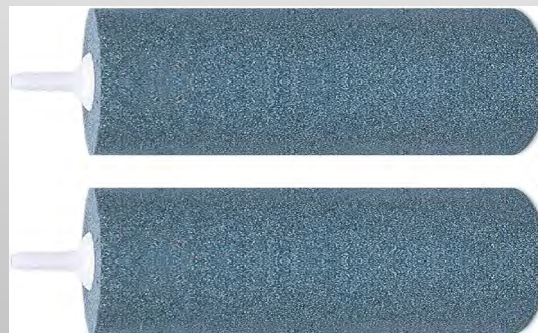
- Net cups are perfect for starting seeds, cuttings and are used in many hydroponic systems.
- Free floating Styrofoam sheets, cut out to hold the net pots and plants



Air Pump

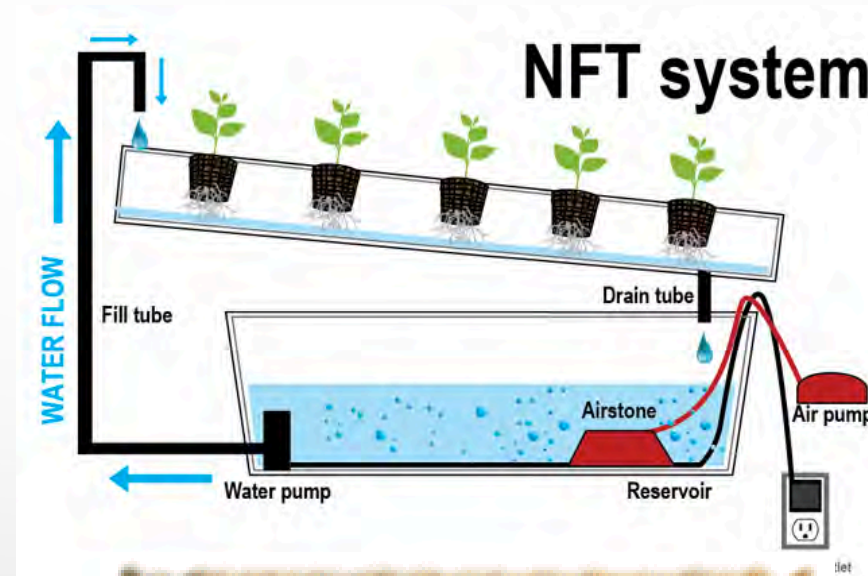
Air movement is vital to root development!

Set up your air pump, line and air stone in the bottom of the aquarium or tank.



Nutrient Film Technique Systems -NFT

- Also known as gutter hydroponics.
- Nutrient solution washed onto plant roots.
- Reservoir contains nutrient solution which is pumped through system using a water pump.





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NUTRIENT FILM TECHNIQUE
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Hydroponic Grow Tower – Vertical NFT



Lettuce Grow Tower

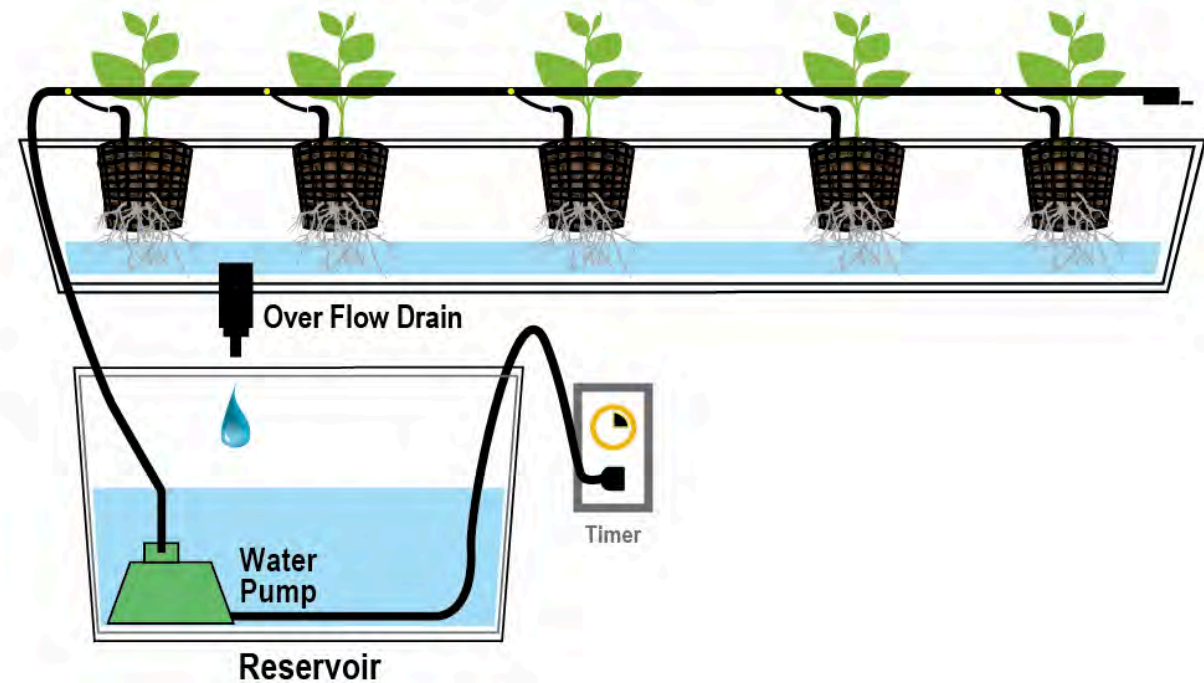


Continuous Drip Systems

- Nutrient solution dripped onto plant from a line either above the plant or sitting on the grow medium.
- Water and nutrients in separate tank pumped through system.



Drip System



Aeroponic systems

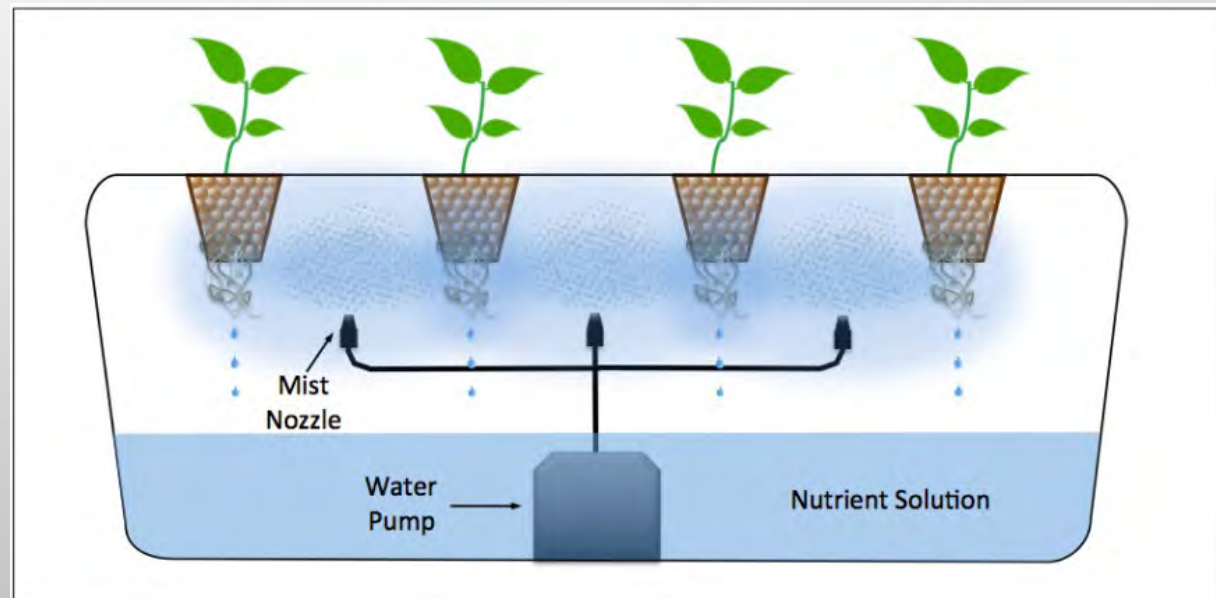
- Nutrient solution sprayed or misted onto roots in growing chambers where roots are suspended in air.
- Used in many grow tower commercial systems.
- Nutrient solution can be in a grow chamber or outside.



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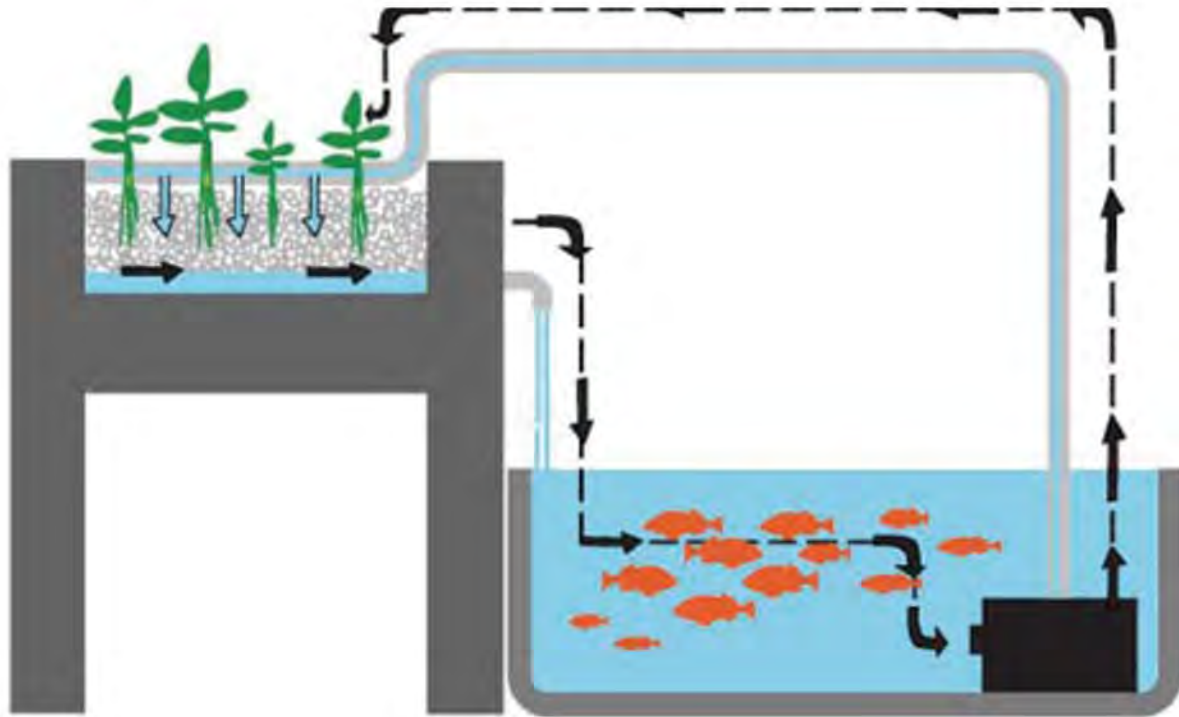


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Aquaponics System

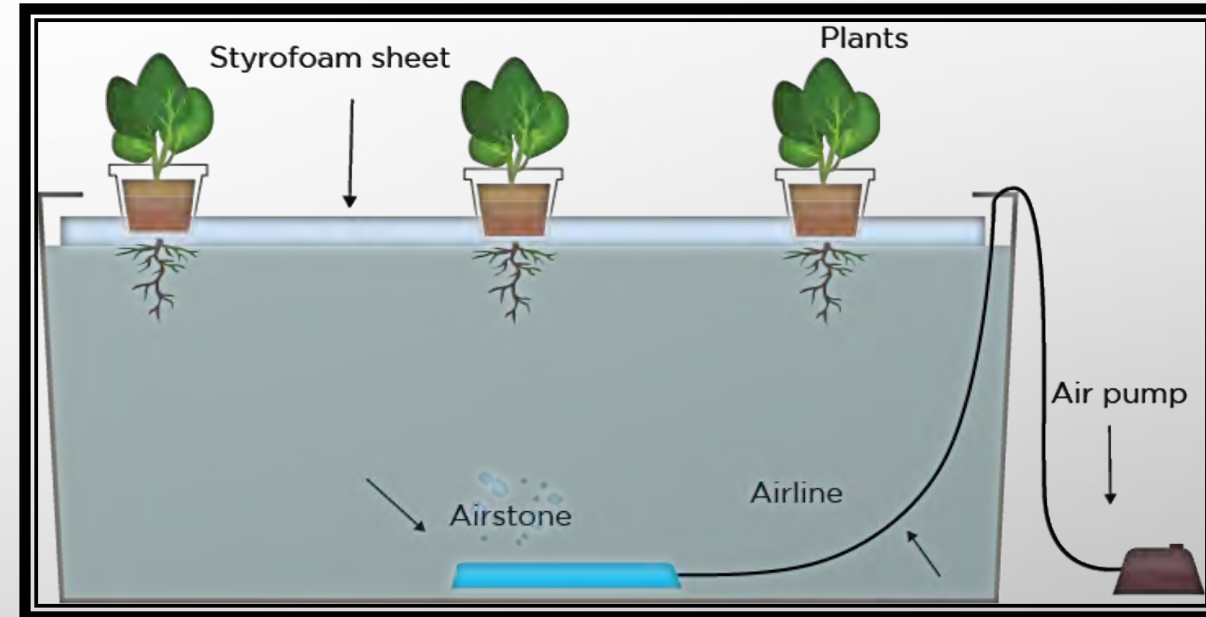
Aquaponics is a method of growing fish and plants in a recirculating, symbiotic, constructed system.

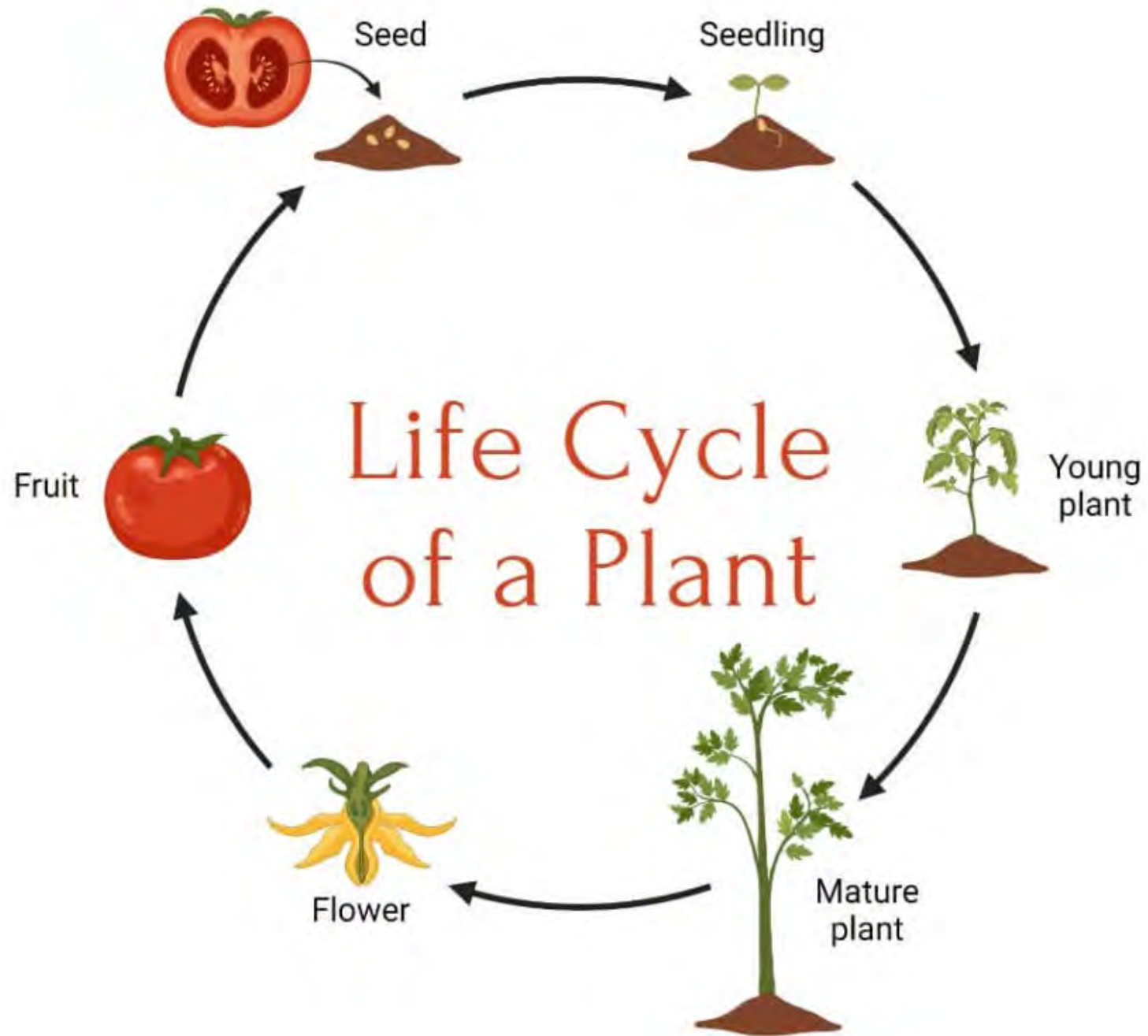


Plant Needs

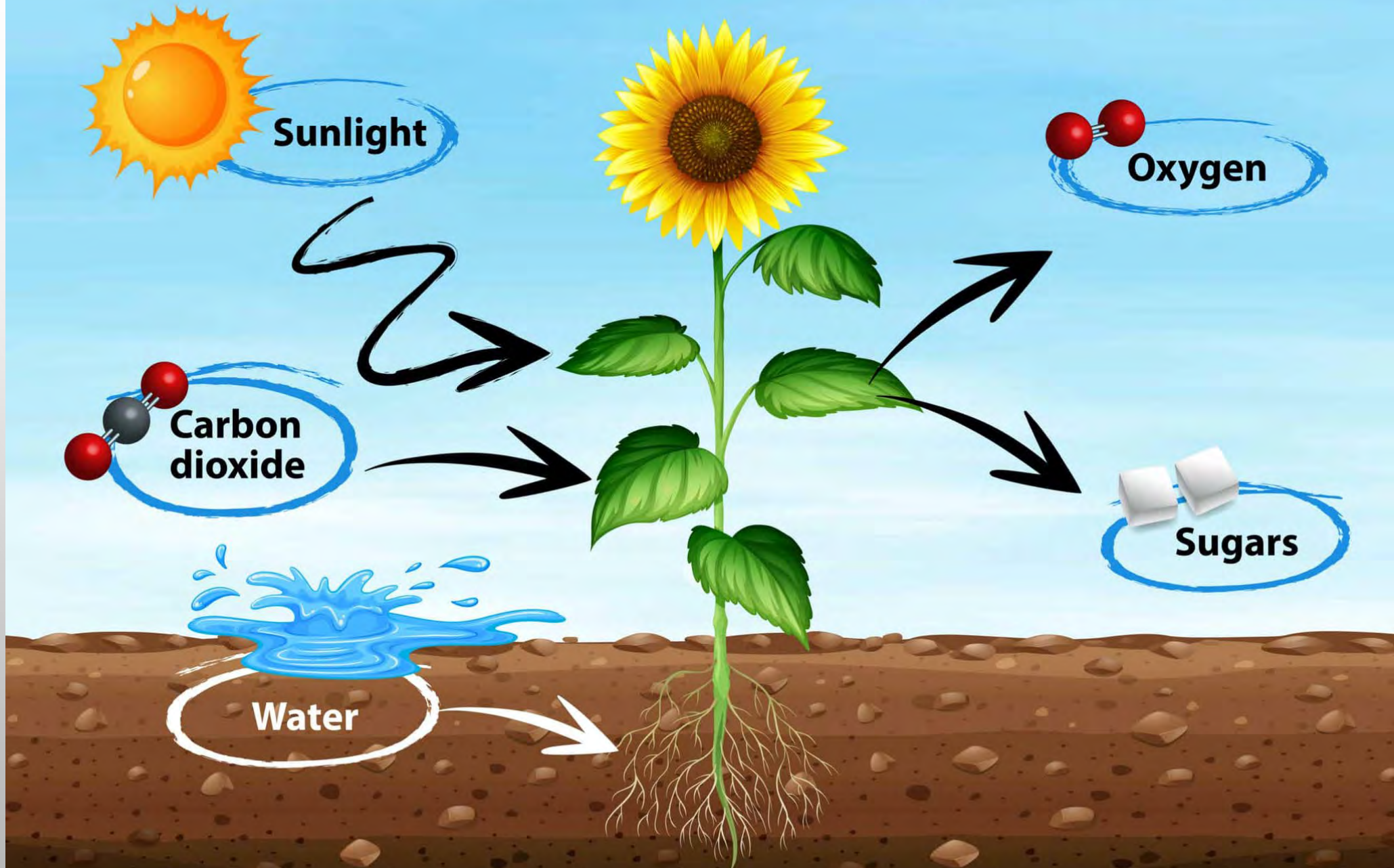
What to Consider When Growing - LAWNSS

- **L**ight – sunlight or equivalent
- **A**ir – CO₂ and Nitrogen and Oxygen
- **W**ater
- **N**utrients –NPK and Micro
- **S**pace
- **S**upport – Media for stability



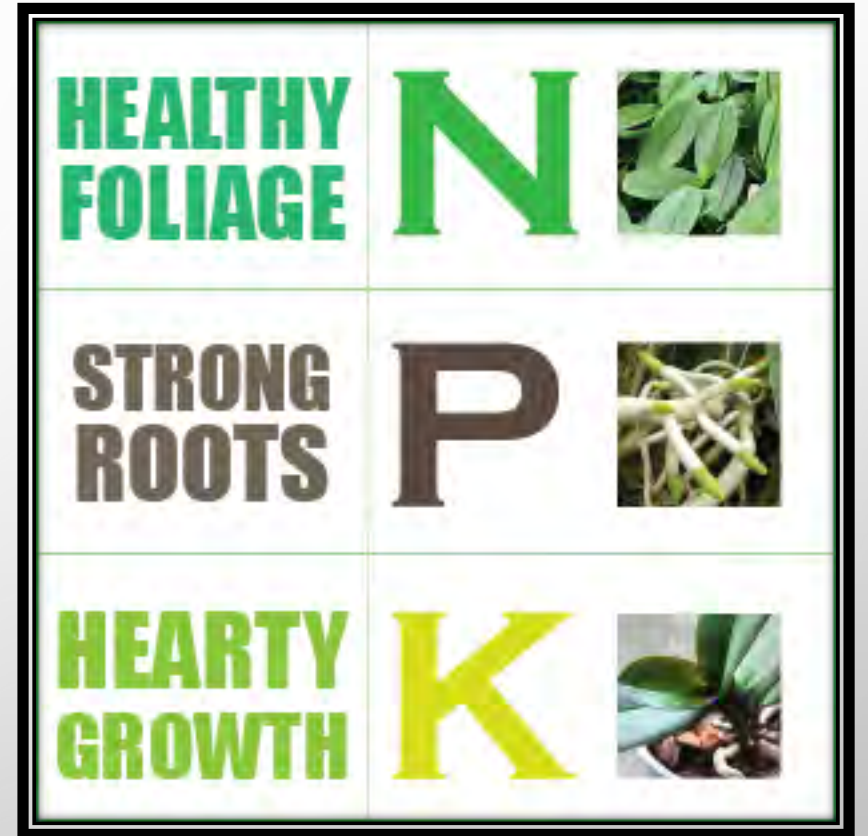


Process of Photosynthesis



Nutrients

- N- Nitrogen for the production of leaves, stem growth, and building plant cells.
- P – Phosphorus for the development of flowers, fruits, and healthy root growth.
- K – Potassium for photosynthesis



Micro Nutrients

- **Sulphur** to heighten the effectiveness of phosphorus and for plant energy.
- **Iron** for the production of chlorophyll.
- **Manganese** for the absorption of nitrogen and energy transference.
- **Zinc** for energy transference.
- **Copper** for producing chlorophyll.

- **Boron** for cell wall stability.
- **Magnesium** for producing chlorophyll and distributing phosphorous.
- **Calcium** for root growth and the absorption of potassium.
- **Chlorine** for photosynthesis.
- **Molybdenum** for assistance in chemical reactions.

Lighting

1. **Fluorescent** Energy inefficient, high heat generation. NOT the best option but in a pinch they will work.

2. **LED Lights** – Energy efficient, low heat output, long lasting, low cost. LED lights are recommended for optimal successful growing.

Lights must be kept on a consistent schedule. A timer is a very good idea. 12 hours on and 12 hours off for leafy greens is optimal.



Why Can't We Use Just Sunlight?

- Window light is inconsistent and less in the winter.
- Windows block important light waves for proper growth.
- You will get leggy plants due to inconsistent light.



What Should I Grow in My System?

- Lettuce is easiest
- Kale, other leafy veggies
- Leafy Herbs
- Cucumbers
- Strawberries
- Peppers and Tomatoes (expert, DO NOT start with them)

Grow what you want to eat!



Most Commonly Grown Plants



Lettuce



Basil

Advice for Starting Successful Seedlings

- Choose the media size that fits your system.
- Add one to two seeds per media block/pod.
- Add water to tray.
- Gently spray seeds from top with spray bottle.
- Wait until the second set of leaves emerges before putting in your hydroponic system
- Label plant varieties you are growing!
You WILL not remember what you planted where.



Lighting for Grow Towers



Lighting for Seedling Starting or Deep Water Hydroponics

Have lights on a chain with S-hooks to keep lights within 4" of plants and raise and lower lights with ease.



Biggest mistake new gardeners make is not having the lights close enough to the seedlings.

Hydroponic Grow Media

Media: substance or material in which something exists or grows, from the soils and other materials for plant growth. Provides stability for plants

Rooting Plugs



Rock Wool



What is Rockwool?

- Rockwool is made from rock which has been melted and spun into fibrous cubes.
- Rockwool is a form of Perlite in which the pebbles or rocks anchor the plant down so they don't just float up above the water.
- Rockwool is the most popular medium for germination seeds hydroponically.



Rooting Plugs



Made with fine sphagnum peat moss with a compostable glue.

Maintenance

- Monitor Water Levels DAILY!!!!
- Watch plants for changes. If Keep heat consistent as possible. Don't put near a window if possible.
- Watch for pests.
- Keep lights clean as possible.
- Clean tank/bottom bucket at least once every 3-4 weeks,
Fully wash whole system every 4-6 months.