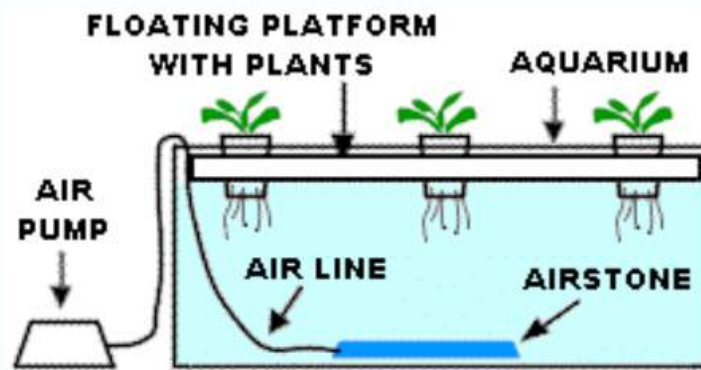


# Hydroponic Gardening



[www.simplyhydro.com/](http://www.simplyhydro.com/)



Adapted from a presentation originally created by Marilyn Krause, Middle School Science Teacher at Ryan Middle School in Fairbanks, Alaska

# What is Hydroponic Gardening?

- Hydroponics comes from the Greek language and it literally means let the water do the work.
- "hydro" means "water"
- "ponos" means "work".



growgenius.co.uk  
/

Soil-less growing!

# 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.

# Soil-Less Growing?

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



Chena Hot Springs Resort, Fairbanks Alaska

# History of Hydroponic Gardening?

Although hydroponics today involves tables, pots, pumps, and high-tech lights for indoor gardens, it is nothing new.

Hanging Gardens of Babylon are believed to have been one of the first mass scale hydroponic projects.

The Hanging Gardens of Babylon were built around 600 B.C., commissioned by King Nebuchadnezzar II.

The water was from the Euphrates River.



<http://static.planetminecraft.com/>

# Ancient Aztec Gardening

The Aztec's were tremendous thinkers, scientists, engineers and designers.

Living on the marshy edges of Lake Tenochtitlan, in what is now Mexico, they devised a sophisticated farming system built on artificial "floating islands."



<http://www.ancient-origins.net/>

# The Present...

## Large Scale Hydroponic Farming

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



[greenlivingideas.com/](http://greenlivingideas.com/)



Chena Hot Springs Hydroponics

# Advantages

**Faster Growth-** Hydroponics works by automatically getting the complete nutrient mixture and water to the roots without drowning the plant. Plants get everything they need all the time, so they do not waste growing a lot of roots or searching for nutrients.



# Advantages

**No Weeds/ Reduced Pests-** Gardening without soil eliminates the weeds so you do not need weed sprays. Also, because there are no weeds, there will be no backache from a hoe or rototiller.

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



# Advantages

**Great Plant Quality and Taste-** Since the plants get everything it needs, all the time, it will reward you with great taste, strong and fast growth, and overall plant quality.



# Disadvantages

- Daily attention can be necessary.
- Specially formulated, soluble nutrients must always be used.
- Pests and diseases remain a big risk.
- Some water born diseases can spread rapidly in recirculation system.

# 6 Types of Hydroponic Systems

- Passive Wick System
- Deep Water Culture System – Floating Platform
- Nutrient Film System – Gutter System
- Continuous Drip System
- Ebb and Flow System
- Aeroponic System

# Passive vs. Active

- **Passive systems** (no moving parts) are great for beginning hydroponics gardeners because they are inexpensive, portable, and simple to set up.
- **Active systems** employ pumps and other devices to deliver nutrient solutions to plant roots.



[vermontpassive.com](http://vermontpassive.com)



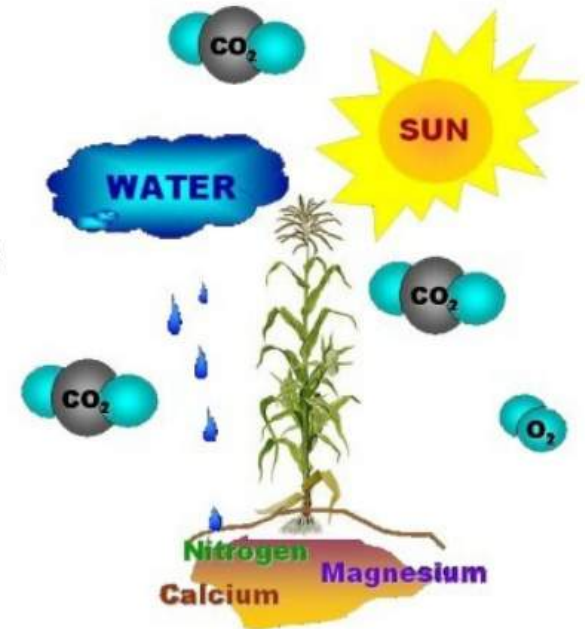
[basichydroponicsystems.files.wordpress.com](http://basichydroponicsystems.files.wordpress.com)

# Plant Needs

What is needed for a plant to survive?

- Water
- Sunlight
- Air
- Anchorage (root system)
- Nutrients (usually in soil)




What Plants  
Need



# 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



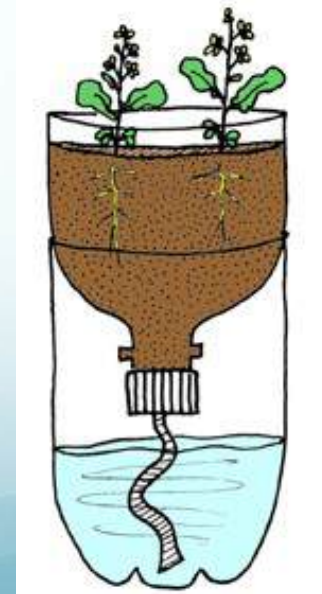
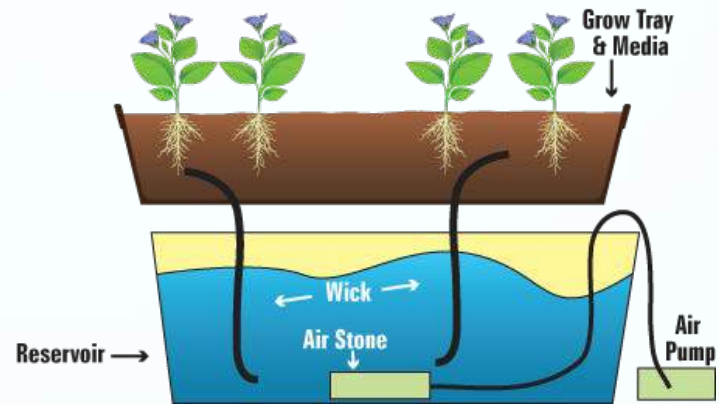
HEALTHY FOLIAGE	N	
STRONG ROOTS	P	
HEARTY GROWTH	K	

# Trace Elements

- 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 unknown reasons.
- 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.

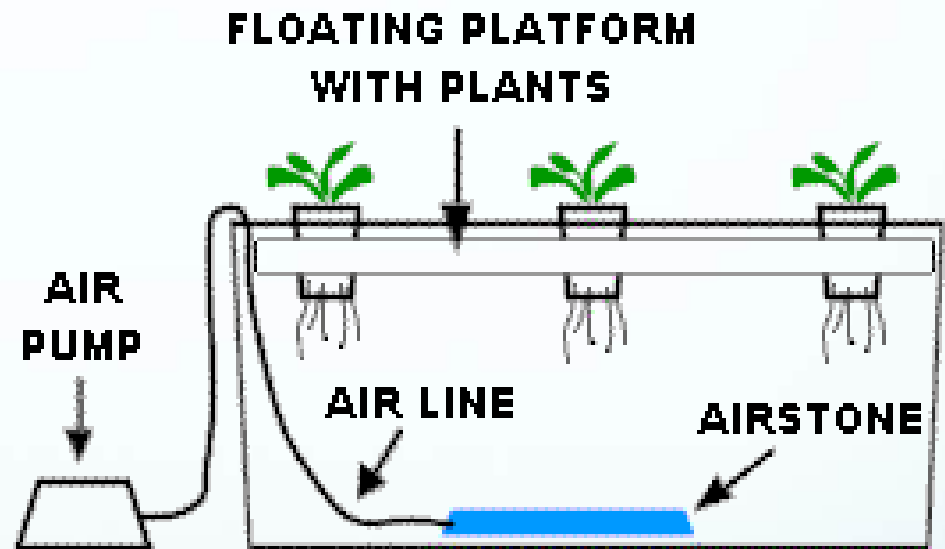
# Passive Wick System

- 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.



# Water Culture Systems

- Plants grow on platform with roots suspended into solution
- Air bubbled into nutrient solution to provide oxygen for roots
- Does not work well with some types of plants or long-term growing



[www.simplyhydro.com/](http://www.simplyhydro.com/)

# Simple Water Culture System Floating Platform Set-up with Fish Tank



# Floating Platform System In a Plastic Storage Tub



# Foam and Plant Pots

- Net cups are perfect for starting seeds, cuttings and are used in many hydroponic systems.
- Cut the Styrofoam sheet in a rectangle with the measurements 1 inch less than the inside measurement of the aquarium for both the length and width. This allows for a  $\frac{1}{2}$  inch gap between the platform and the side of the aquarium around the entire perimeter. It is needed so the platform will float freely and not bind with the sides of the aquarium.
- Cut holes in the blue foam the size of the net pots.
- Place net pot in hole to make sure that it fits snugly



amazon.com





# Plants



- Lettuce is best
- Kale, other leafy veggies
- Herbs
- Peppers
- Tomatoes (expert)



- Start with seed germination, and rock-wool is the most popular medium for germinating seeds.
- For seeds, you should sprinkle water from above on each cup periodically until seeds have germinated and roots are forming.

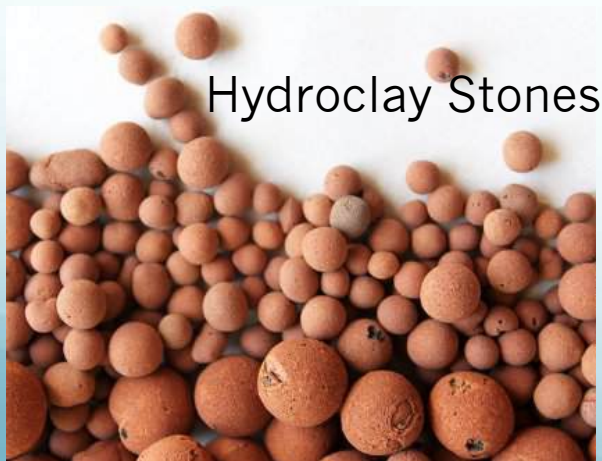


# Growing Medium

- *Medium:* substance or material in which something exists or grows, from the soils and other materials for plant growth.

- Sand
- Styrofoam
- Vermiculite
- Anything Inert!

Perlite

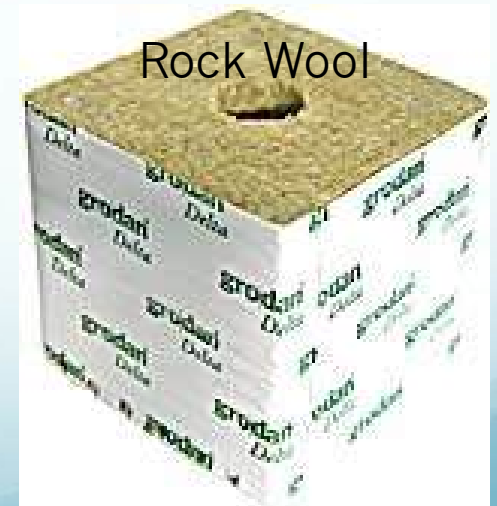


Hydroclay Stones

Vermiculite



Rock Wool



# Rapid Rooters and 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.



# Seedlings



# Nutrient Solution



- Fill the aquarium with water.
- Mix in the nutrient according to the label.
- Test Ph, use adjuster if necessary
- Keep the water level constant. Add often.



# Air Pump

Oxygen is vital to root development!

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

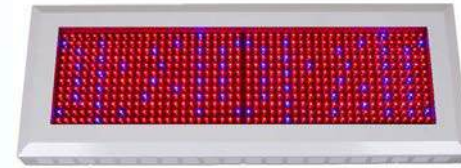


# Lighting

1. **Fluorescent** somewhat inefficient, must be kept close to the plants.



2. **LED Lights** – Energy efficient, low heat output, long lasting



3. **HID Lights** - Most cost effective, very long life



*High Pressure Sodium* – provides more of the red/orange spectrum for flowering and fruiting.



*Metal Halide* – Provides more blue/green spectrum for vegetative growth. ***Lights must be kept on a consistent schedule. A timer is a very good idea.***

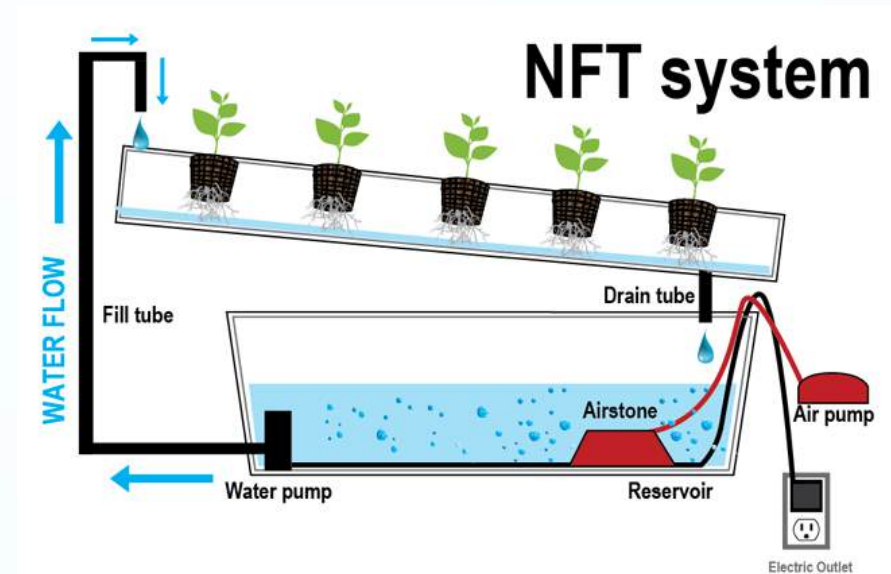
# Sunlight?

- You can place plants in direct sun in a window, but unfortunately that often isn't enough for proper growth especially in the winter/early spring months in Alaska.
- It probably isn't a good idea to rely just on sunlight for plant growth. It causes leggy plants.



# Nutrient Film Technique Systems

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

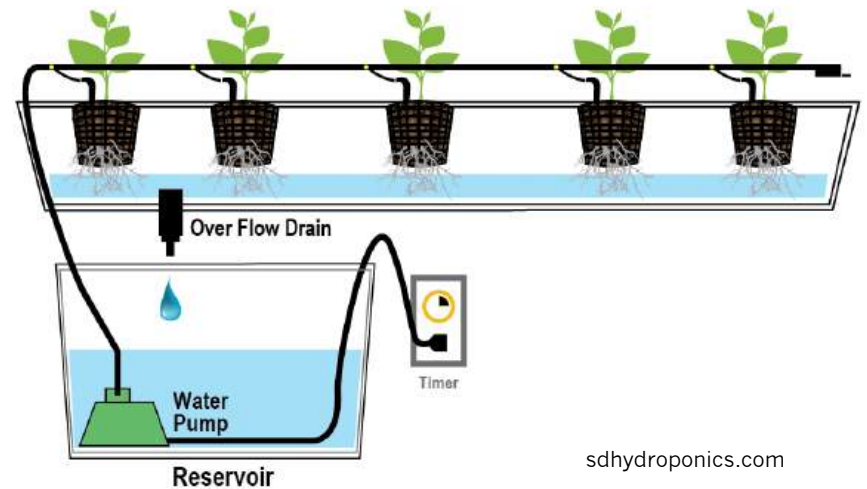


# Continuous Drip Systems

- 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

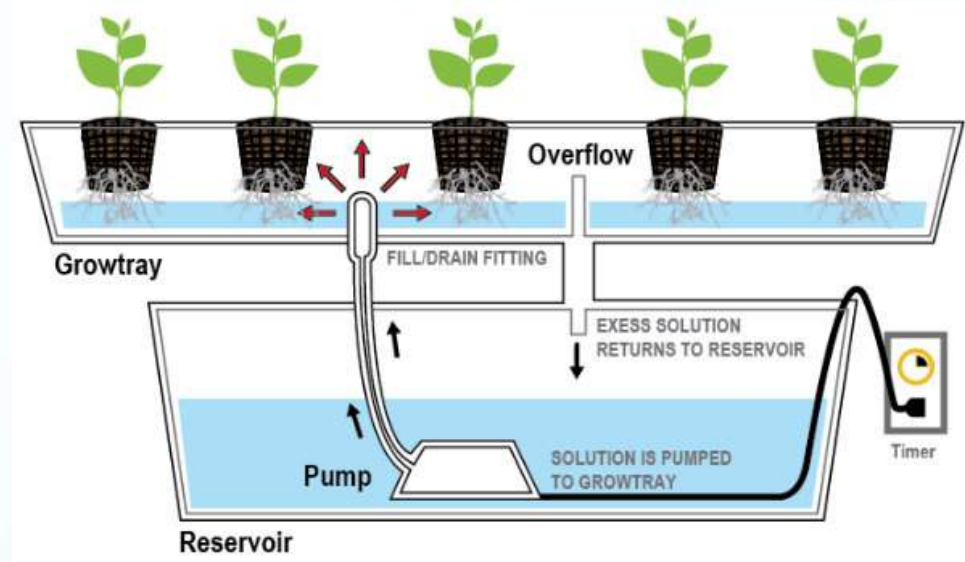


# WHEN A NURSE TAKES UP GARDENING



# Ebb and Flow systems

- Nutrient solution is temporarily and regularly flooded into the grow tray using a submersed pump connected to a timer.
- When the timer is off, the solution flows back into the reservoir.
- Plants can dry out during cycles

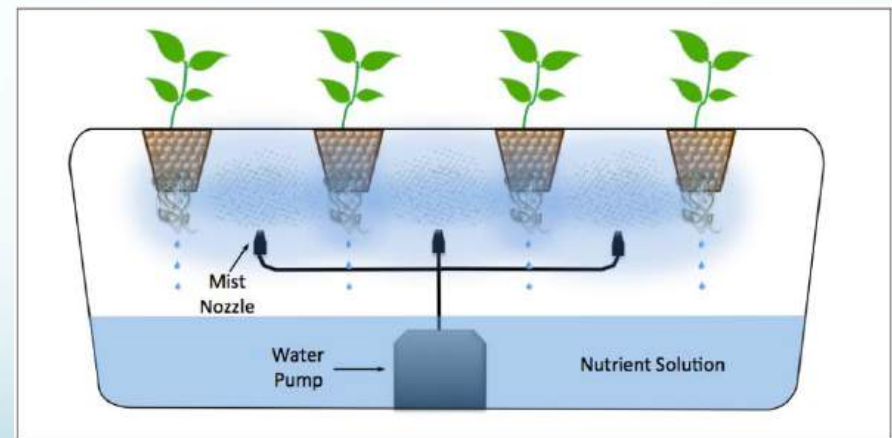


# Aeroponic systems

- 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.

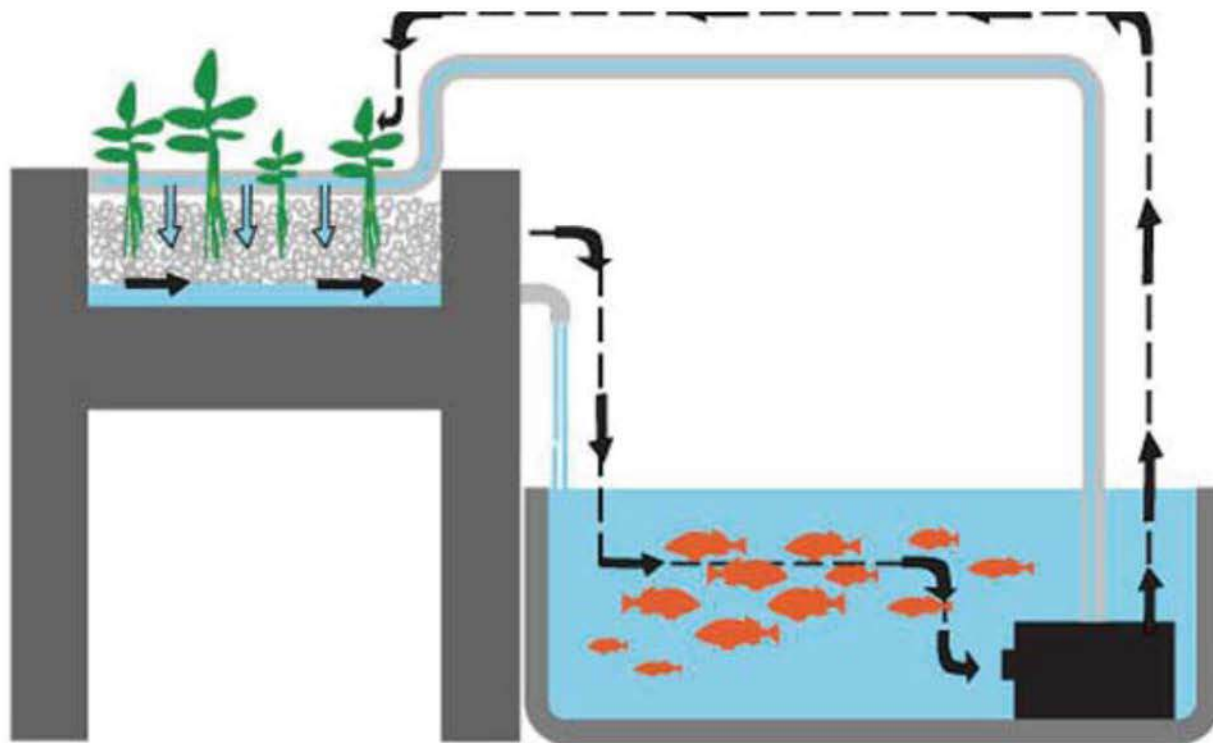


icangarden.com



# Aquaponics System

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

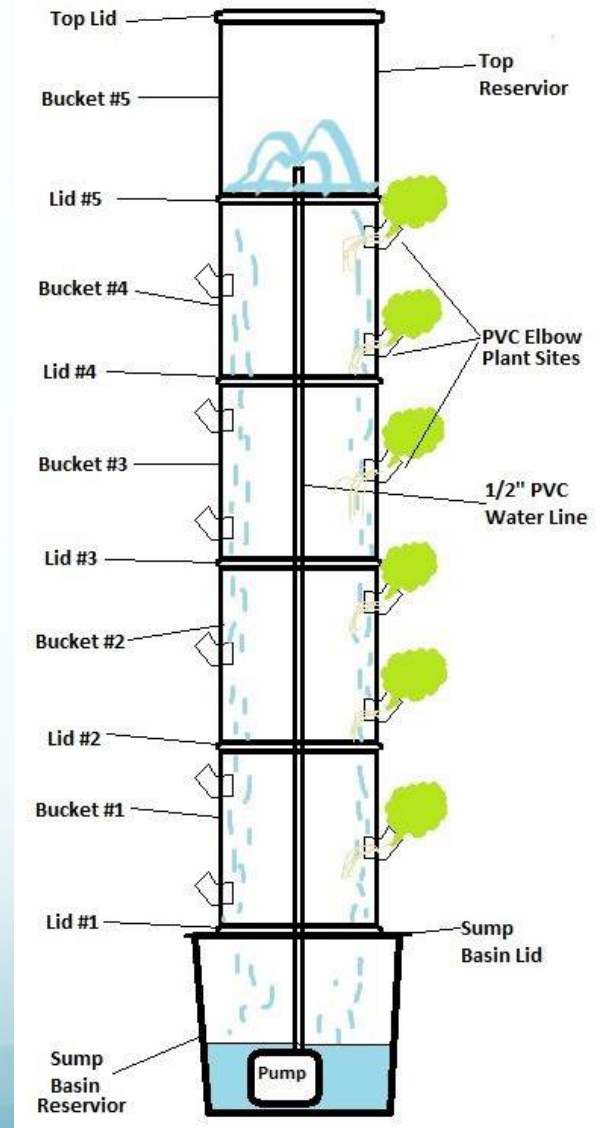


# Simple Aquaponics System with Floating Platform



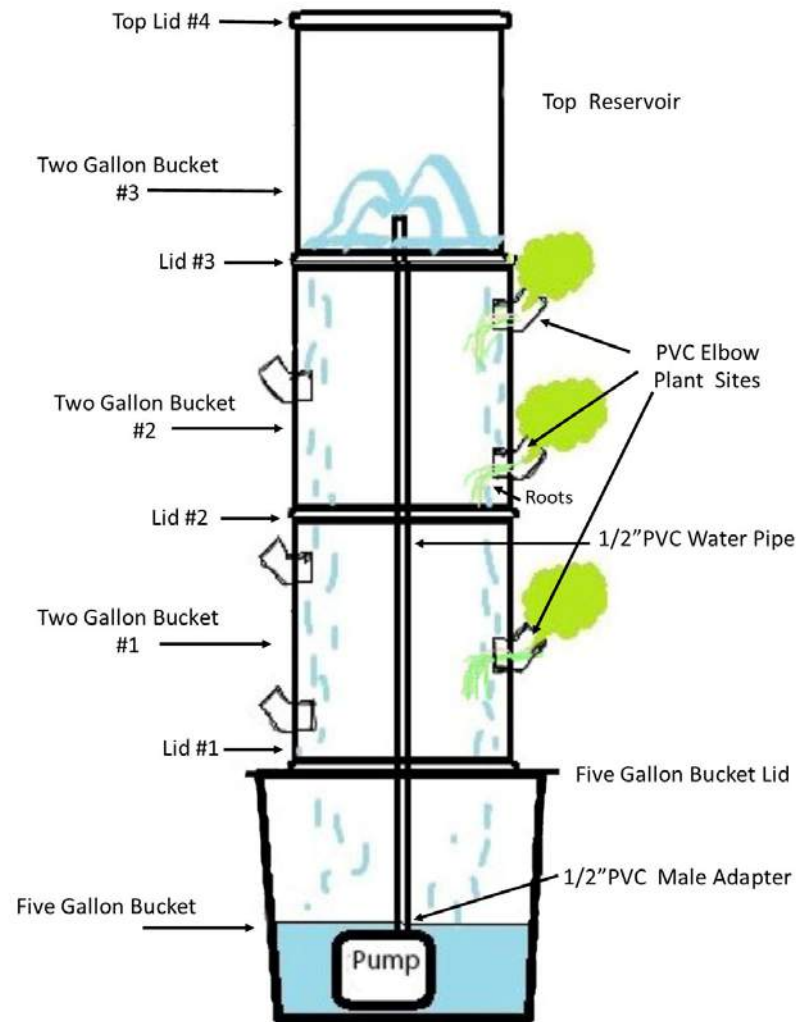
# CHS Grow Tower System

- Minimal Space required
- Continuous Drip System
- Easy to build, easy to get supplies
- Easy to maintain





# Modified Smaller Tower



# Maintenance

- Check your pH levels at least every other day to maintain proper growing environments for your plant.
- Watch plants for changes. If leaves turn yellow, adjust/ increase fertilizer.
- Keep lights in good working order.
- Clean tank at least once every 3 weeks, to keep algae growth to a minimum.