

Webinar:

Harnessing Growth: Hands-on Hydroponics and Aquaponics Education



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Presented by

Jamey McIntosh

Educations Programs Manager

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Learning Opportunities

Career Exploration

STEM

Sustainability

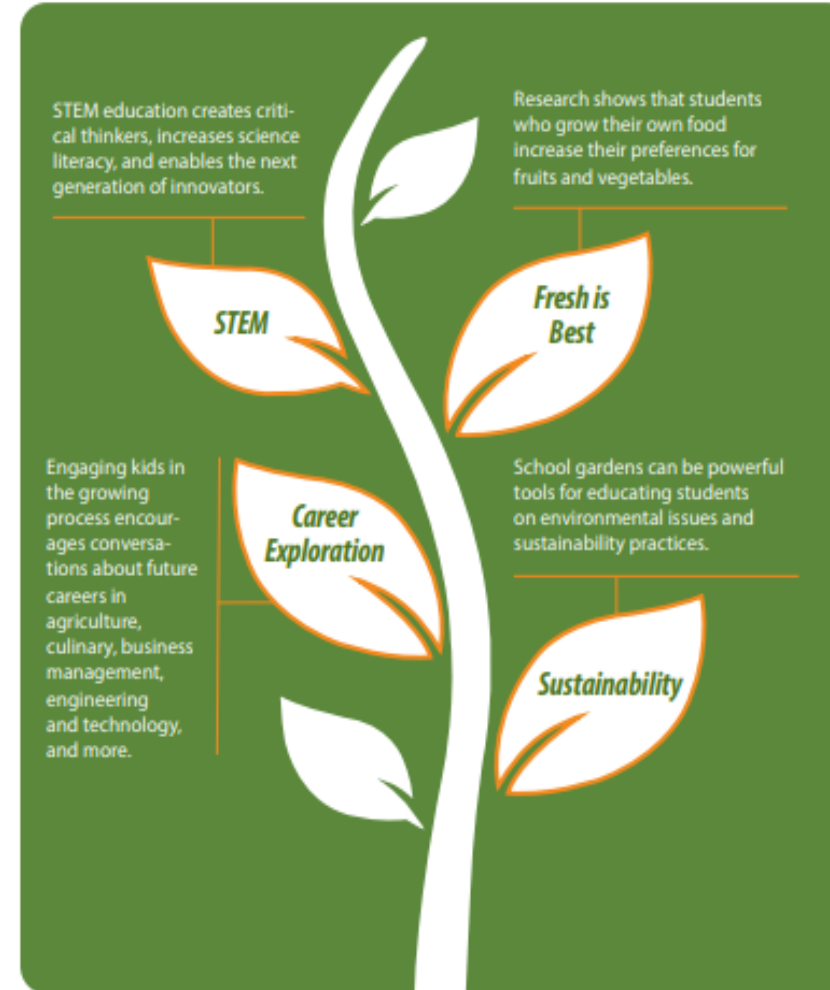
Farm to Table

Nutrient Rich

Learning Engagement

Grow your food. Grow your mind.

How growing plants can increase student engagement





Types of Hydroponics Systems



LEARN: Types of Systems

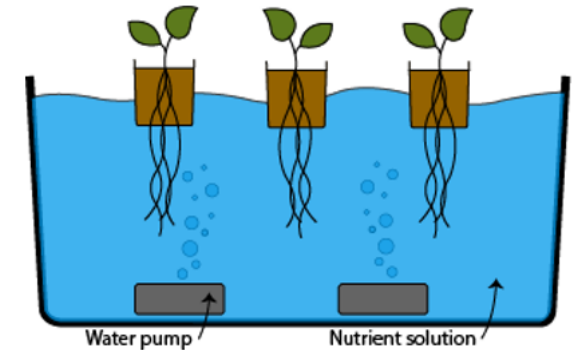
Typical Types of Hydroponic Systems

- Deep Water Culture (DWC)
- Ebb and Flow (Flood and Drain)
- Drip System
- Nutrient Film Technique (NFT)
- Aeroponics
- Aquaponics

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Deep Water Culture (DWC)

- Plant roots are suspended in a nutrient solution
- Oxygen is released into the water to prevent the roots from drowning
- A variation of this is known as bubbleponics

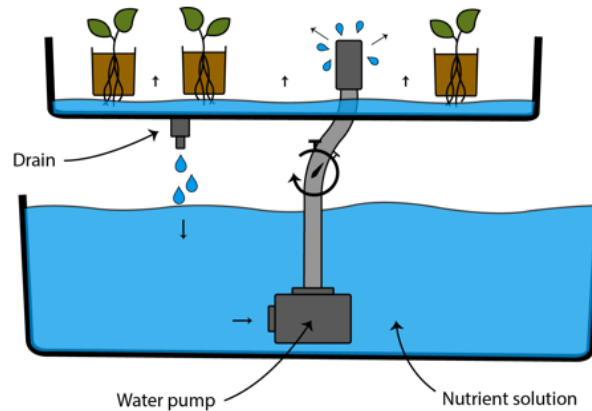


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LEARN: Types of Systems

Ebb & Flow (Flood and Drain)

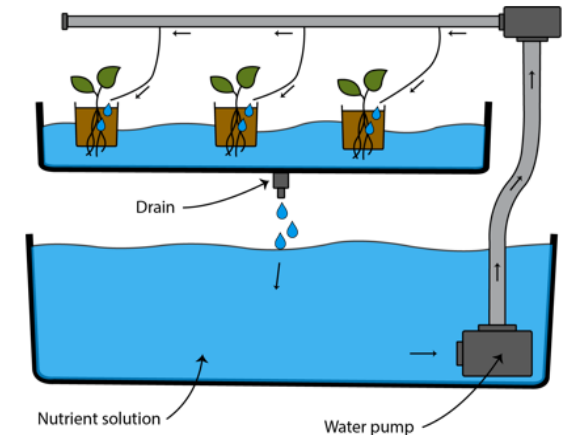
- Water pump on a timer periodically floods the plants with water that includes a nutrient solution
- Water slowly drains back into the nutrient solution



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Drip System

- Water pump draws water from a nutrient solution and drips it continuously on the plants
- The drain returns the water to the nutrient solution

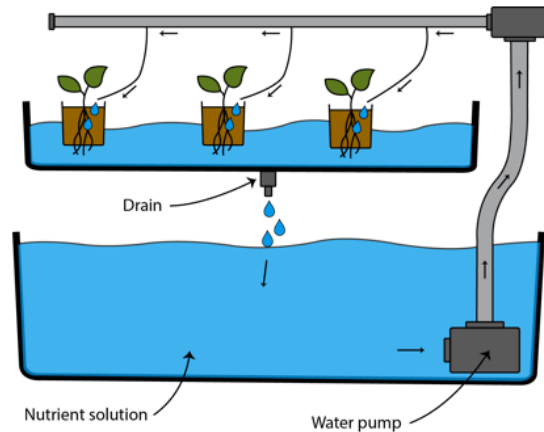


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Drip System

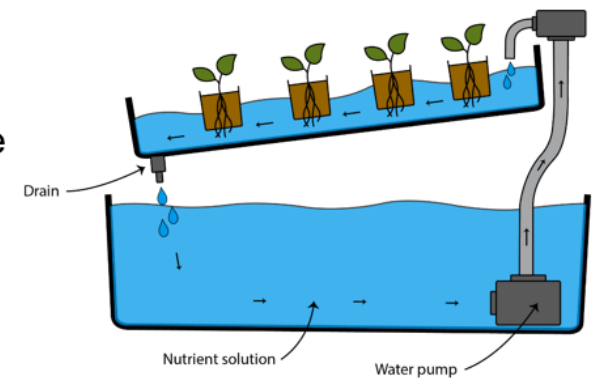
- Water pump draws water from a nutrient solution and drips it continuously on the plants
- The drain returns the water to the nutrient solution



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Nutrient Film Technique (NFT)

- Plants are secured to a ramp at a slight tilt and water is pumped onto the ramp from a nutrient solution
- Water flows down the ramp and drains into the bath, continuously bathing the plant roots

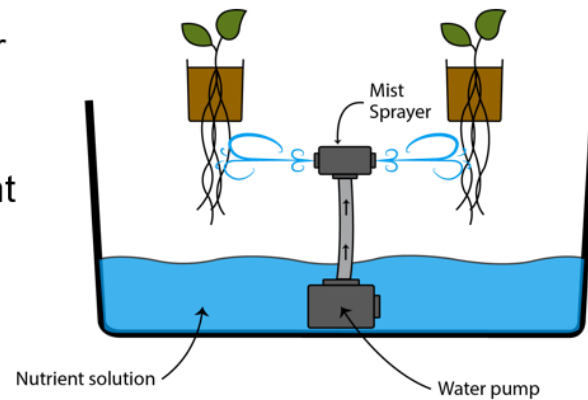


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LEARN: Types of Systems

Aeroponics

- Water pump draws water out of a nutrient solution and sprays mist directly onto the roots of the plant



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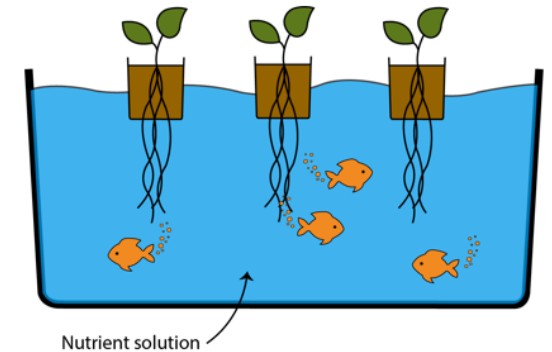
Introduction to Hydroponics
Curriculum

15

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Aquaponics

- Nutrients in the fish waste are converted from ammonia to nitrogen and provide nutrients for the plants
- Plants filter the water to keep the fish healthy



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Introduction to Hydroponics
Curriculum

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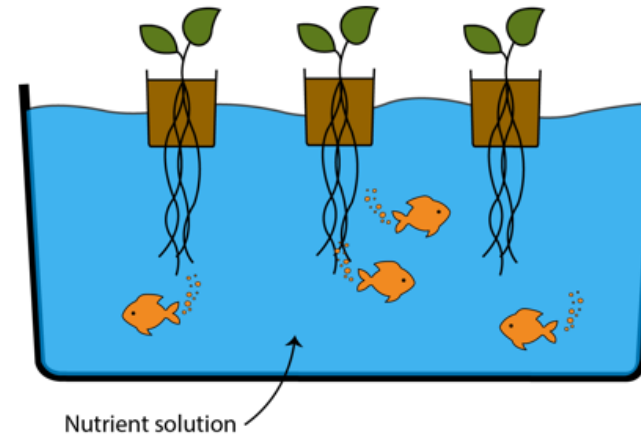
Aquaponics Systems



LEARN: Types of Systems

Aquaponics

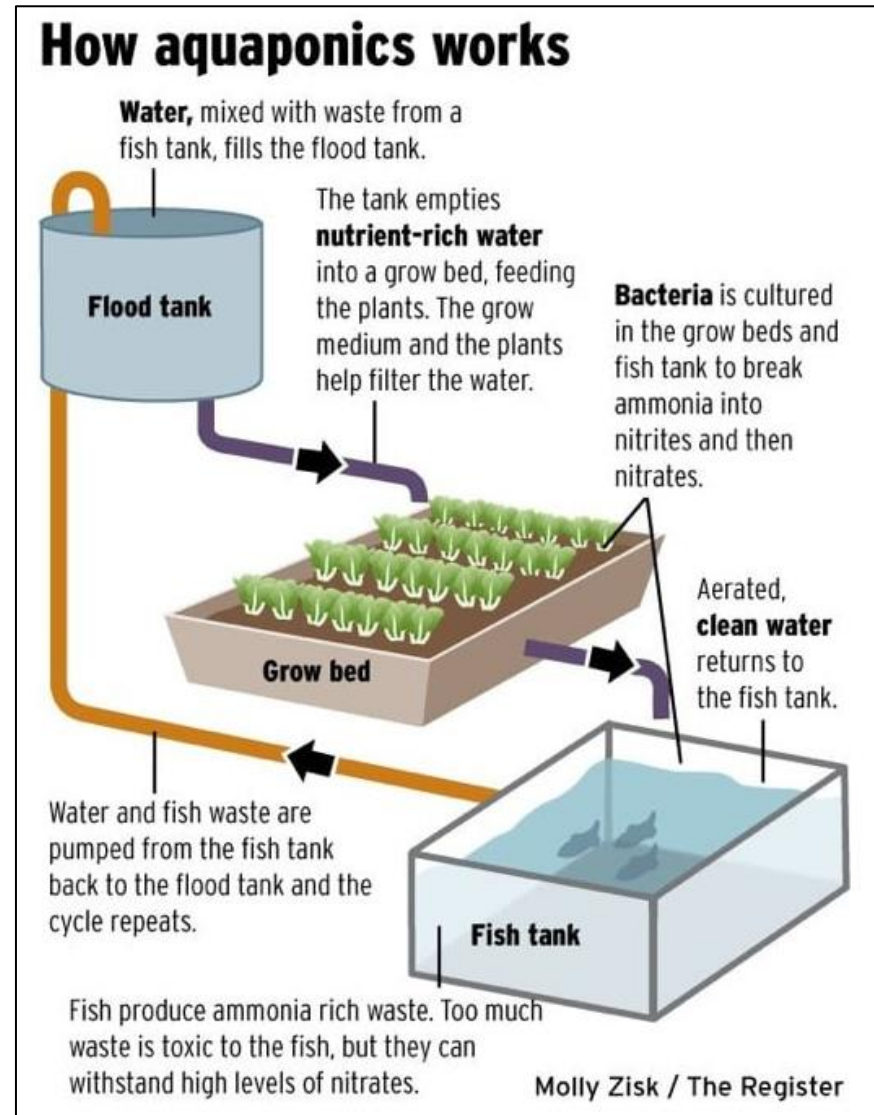
- Nutrients in the fish waste are converted from ammonia to nitrogen and provide nutrients for the plants
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How it works?

- Feed the Fish
- Fish feed the plants
- Plants grow and clean the water
- Clean water keeps the fish healthy





Five Key Reasons for Growing Systems



Speeds Up Grow Times

Increases Food Security

Saves Space



Eliminates Chemicals



Uses Less Water



Why Grow With Hydro/Aquaponics?

1. Limited Space:

In many locations, especially cities, there isn't always enough space or soil available to grow plants in the ground

These Systems allows people to grow gardens in limited space

Why Grow With Hydro/Aquaponics?

2. Clean and Efficient:

This type of farming/growing is a clean and efficient way to grow vegetables and other plants

These Systems farming can happen in a closed environment for year-round growing

Why Grow With Hydro/Aquaponics?

3. Solve food shortages and growing issues

This type of farming/growing can help solve food shortages, especially in areas where drought and famine are issues

Where weather conditions are unfavorable for large scale crop production, hydroponics can help overcome these weather variables

Why Grow With Hydro/Aquaponics?

4. Increase growth rates and time to harvest

Water and nutrients are continually made available to the plant roots, allowing plants to grow at the fastest possible rate

It can reduce the time between planting and harvest by controlling the growing variables

Biosecurity and environmental factors can help to grow food more readily

Why Grow With Hydro/Aquaponics?

5. Learn and experiment with new ways to grow plants

Test and experiment with the ability to adapt variables and make environmental changes easily

Challenge ideas and growing methodology to find better ways to grow food

Getting Started

How to get started

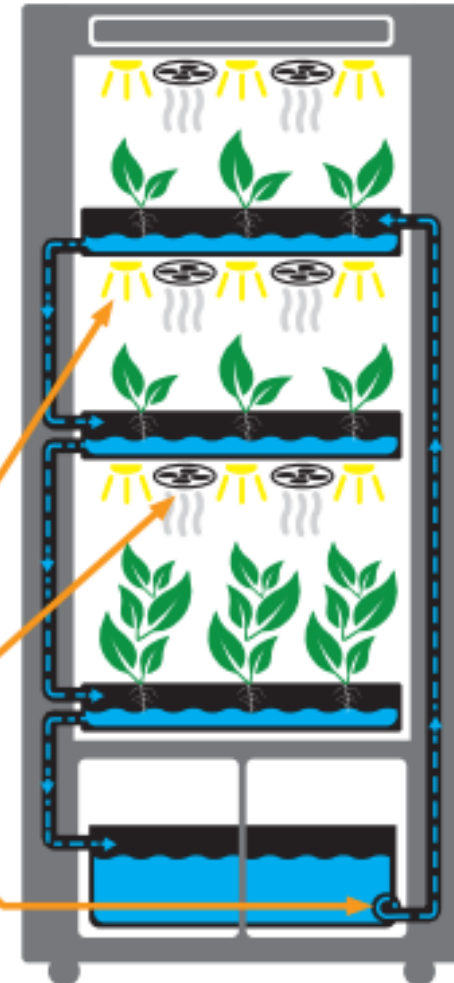
Materials needed:

- Seeds
- Nutrients
- Rock wool
- Growing tray



Hydroponics system parts:

- **Lights**
The LED light array mimics sunlight (including the red-and-blue light spectrum) to help the plants grow.
- **Fans**
The fans help strengthen and reduce injury and disease to the plants. They always run at a consistent speed.
- **Water pumps**
The water pumps circulate the water so that vital nutrients can move to the plant roots.



What can you grow in an Educational Hydroponics System?

Lettuce (Romaine, Butter, etc.)

Germination Period: 4-10 days
Days to Mature: 35-65 days

Kale

Germination Period: 3-10 days
Days to Mature: 55-80 days

Swiss Chard

Germination Period: 7-10 days
Days to Mature: 55-65 days

Peas

Germination Period: 5-7 days
Days to Mature: 35-50 days

Jalapeños

Germination Period: 7-10 days
Days to Mature: 50-80 days

Green Beans

Germination Period: 7-14 days
Days to Mature: 80-100 days

Tomatoes

Germination Period: 6-14 days
Days to Mature: 55-90 days

Cucumbers

Germination Period: 6-10 days
Days to Mature: 55-65 days

Radishes

Germination Period: 3-10 days
Days to Mature: 50-60 days

Growing Difficulty Level



Beginner



Intermediate



Advanced

Planting and Harvesting Cheat Sheet

Plant	Direct Light Needed	Germination	Days to Maturation
Cabbages	Yes	4-10	65-85
Cucumbers		6-10	55-65
Green Beans		7-14	80-100
Kale	Yes	3-10	55-80
Leeks	Yes	7-12	80-90
Lettuce	Yes	4-10	35-65
Radishes	Yes	3-10	50-60
Swiss Chard	Yes	7-10	55-65
Tomatoes		6-14	55-90

EC and pH Values for Different Hydroponic Crops

Plant	pH Range	EC (uS)
Cabbages	6.5-7.5	2500-3000
Cucumbers	6.0-7.0	1700-2500
Green Beans	5.5-6.0	2000-4000
Kale	6.0-7.5	800-1800
Leeks	6.0-6.8	1400-1800
Lettuce	6.0-6.5	800-1200
Radishes	6.0-7.0	1600-2200
Swiss Chard	6.2-6.8	1800-2300
Tomatoes	5.5-6.5	2000-5000

Best Vegetables to Grow with Hydro/Aquaponic

- Lettuce
- Broccoli
- Tomatoes
- Eggplant
- Cucumber
- Cauliflower
- Carrot
- Radish
- Cabbage
- Kale



Best Fish for Aquaponics

- Tilapia
- Koi
- Goldfish
- Catfish
- Perch
- Cod
- Large Mouth Bass
- Rainbow Trout
- Bluegill



What Are the Advantages of Hydro in School?



Brenda Collins-Wheatmore Middle School



Hydroponic Systems for Educational Instruction



Plant Lab Unit

Plant Lab Educational Hydroponics System

Experiment with varying quantities of greens while addressing key plant science, STEM and sustainability efforts with the Plant Lab Educational Hydroponics System. Its three vertical shelves connect to individual water sources, enabling experimentation with plants, water levels and nutrients on each level.

System includes:

- Plant sites: 33
- LED grow lights
- Fans
- Water pump
- 2-gallon water tank/shelf
- Reusable grow cups
- Germination tray, seeds, and rockwool
- 1-year limited warranty

Specifications:

- Plant sites: 33
- Dimensions: 56" x 28" x 15"
- Shelf spacing (grow height): 10"
- Weight: 75 lbs.
- Water capacity: Three 2-gallon tanks, one per shelf
- Fans: one fan per shelf unit
- Voltage: 120v, 60Hz



Plant Producer Unit

Plant Producer Educational Hydroponics System

Grow production-level quantities of greens while addressing key plant science, STEM and sustainability efforts with the Plant Producer Educational Hydroponics System. Its three vertical shelves connect to a single water source, enabling equal nutrient allotment and concentrated growth on each level.

System includes:

- System control panel with sensor monitoring
- Plant sites: 42
- LED grow lights
- Fans
- Water pump
- 7-gallon water tank
- Reusable grow cups
- Germination tray, seeds, and rockwool
- 1-year limited warranty

Specifications:

- Dimensions: 74" x 31" x 15"
- Shelf spacing (grow height): 20" bottom, 12" middle, 12" top
- Weight: 100 lbs.
- Water capacity: one 7-gallon tank
- Fans: two fans per shelf unit
- Voltage: 120v, 60Hz



System control panel with sensor monitoring



Plant Mini Hydroponic Systems

- 5 pack of Mini-Hydroponic units
- Three growing options
 - Ebb and Flow
 - Deep Water Culture
 - Microgreens





Aquaponic Systems for Educational Instruction



Realityworks Newest Growing System

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Aquaponics Educational System

Standalone Aquaponics system with deep water culture system.

14 plant sites for growing

25-gallon freshwater tank for between 5-10 fish

Fully functioning out of the box biofilter and sustainable nutrient system for growing.

Aquaponics

- Open concept biofilter with bell syphon to move the fish nutrients to the plants
- Allows for a lab like learning structure for students to gain knowledge on aquaponics growing
- Top shelf storage and heavy-duty wheels for mobility

Curriculum: How a growing system works

- Use Slide Presentation & Models to help reinforce concepts on this quiz.
- Discuss orally or have students answer and turn in for participation

Main Parts for Hydroponics to Grow

- Lights
- Plants
- Grow medium
- Water and nutrients
- Water movement and oxygenation
- Wind and air flow



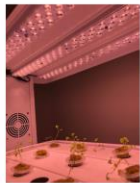
Plants

- Some of the best plants to grow hydroponically:
 - Lettuce
 - Tomatoes
 - Radishes
 - Kale
 - Cucumbers
 - Spinach
 - Beans
 - Chives
 - Basil
 - Mints
 - Strawberries
 - Blueberries
 - Peppers



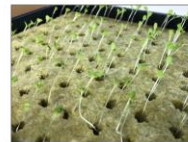
Lights

- Sunlight contains all colors of the spectrum of light
- Plants use little light from the green and yellow parts of the light spectrum
- Grow lights can be full-spectrum lighting, but the light most used by plants is that of the red and blue light spectrum



Grow Medium

- Commonly used to grow plants in for stability and to create a foundation for the plant



Water and Nutrients

- Nutrients definition: the mineral qualities that plants need to obtain optimum growth
- Nutrient solution: the replacement of solid in a medium that supplies the plant with nutrients
- Nutrients used within hydroponics are Nitrogen (N), Potassium (K), and Phosphorus (P)

Wind and Air Flow

- Wind or air flow allows for plants, especially seedlings, to grow sturdy
- Air flow is important to strengthening the plants as well for gas exchange, moving the carbon dioxide to the leaves, and transporting away water (transpiration)

Water Movement and Oxygenation

- Water Movement
 - Creates oxygenation
 - The amount of flow affects the amount of oxygen in the water
 - The more flow (faster moving) the more diffusion of oxygen into the water
- Oxygenation
 - Helps the plant grow
 - Keeps algae and other growths from being as dominant

Now what?

- Download our How to Grow Guide: [Click Here](#)
- Educational Hydroponics and Aquaponics Implementation [Guide](#)
- See all our Hydroponics and Aquaponics resources [here](#)
- Contact us with questions!



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