MASSACHUSETTS FARM TO SCHOOL

Hydroponics for the Classroom Teacher

March 6, 2024

MASS. FARM TO SCHOOL OVERVIEW

Mass. Farm to School strengthens local farms and fisheries and promotes healthy communities by increasing local food purchasing and education at schools.

Get involved through our:

- Professional learning opportunities
- Networking
- Policy/Advocacy
- Communications

Presenter

Graeme Marcoux

Graeme has been teaching Environmental Science at Salem High School since 2005 and is passionate about bringing science content to life in the lab and in the field with his students.

Overview

1. What is hydroponics?
2. Simple to complex systems.
3. The basic components.
4. Rooted in the standards.
5. Curricular connections.
6. Questions and Clarification

What is Hydroponics?


SHS Hydroponics Lab

“Hydroponics is the technique of growing plants using a water-based nutrient solution rather than soil…”

- Hydro = Water
- Ponics = Work or Labor
- Hydroponics vs. Aquaponics

References:
(“Hydroponics | National Agricultural Library”)

Hydroponics vs. Aquaponics

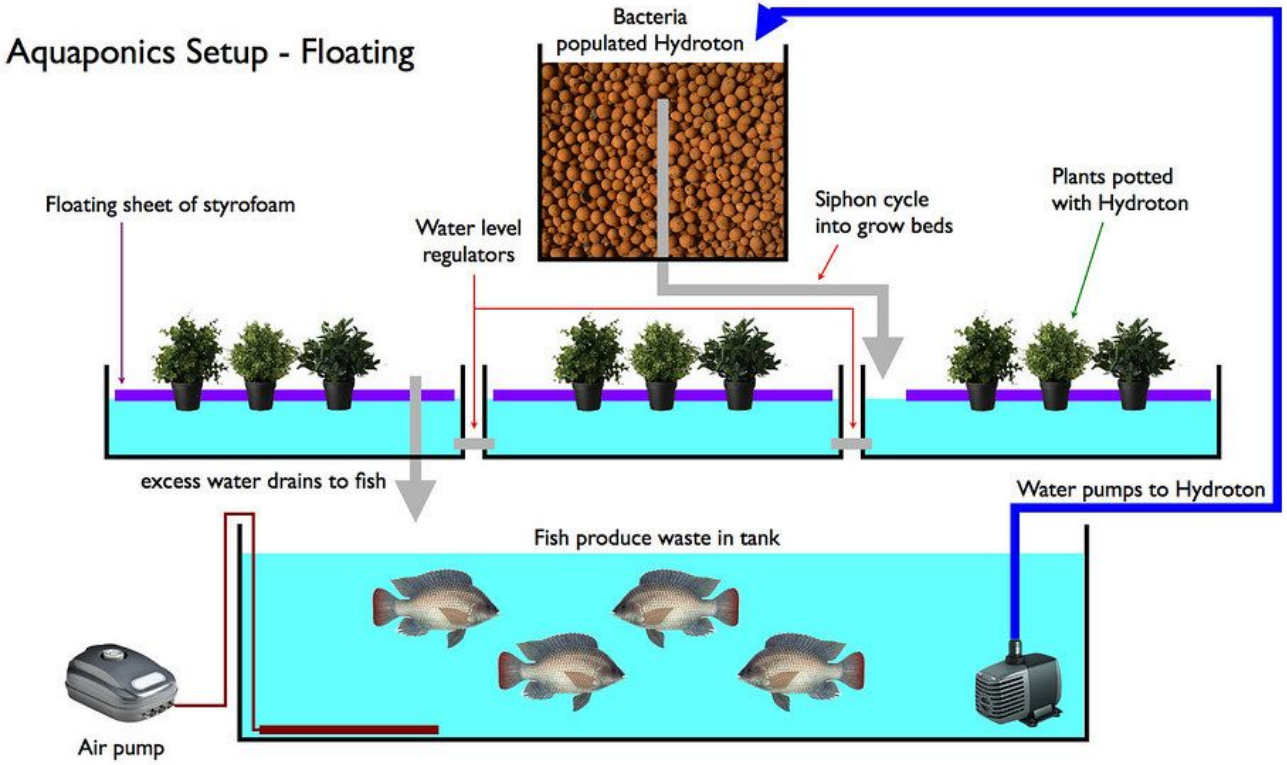
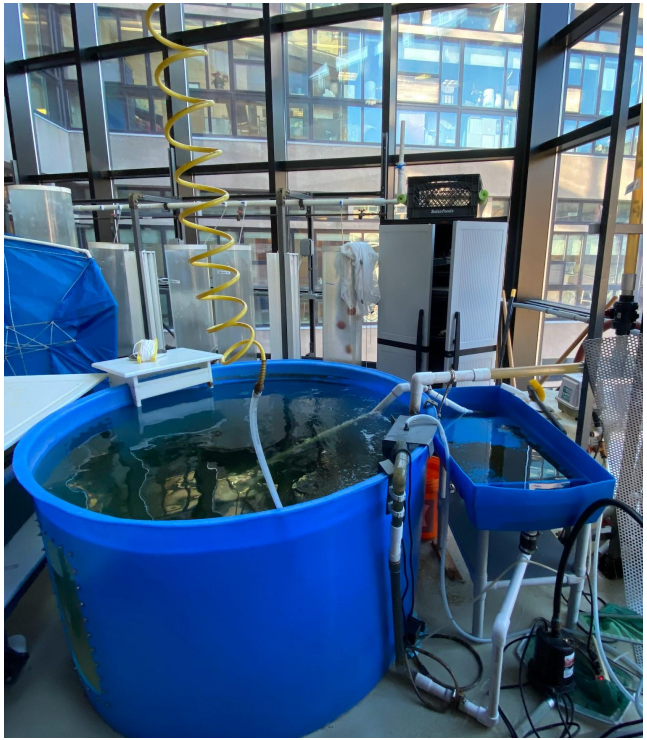
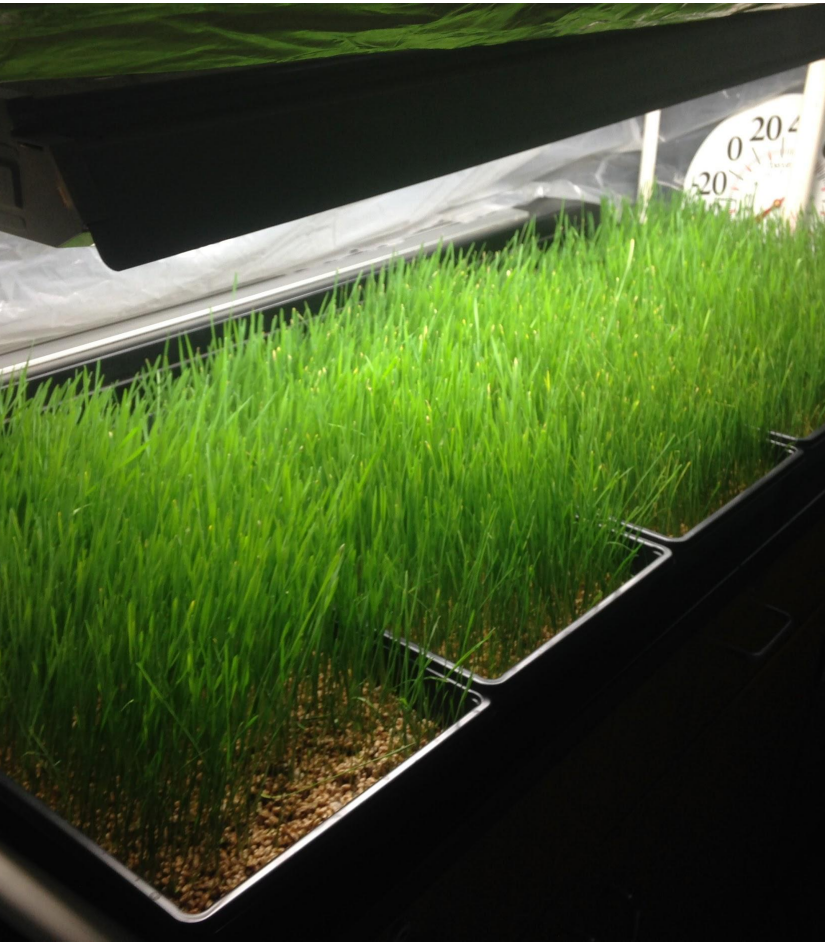


Photo credit
https://flic.kr/p/e3hQ7a

Hydroponics vs. Aquaponics



Simple to Complex Systems- Both have benefits.



- Classroom hydroponics should be scaled to your curricular needs.

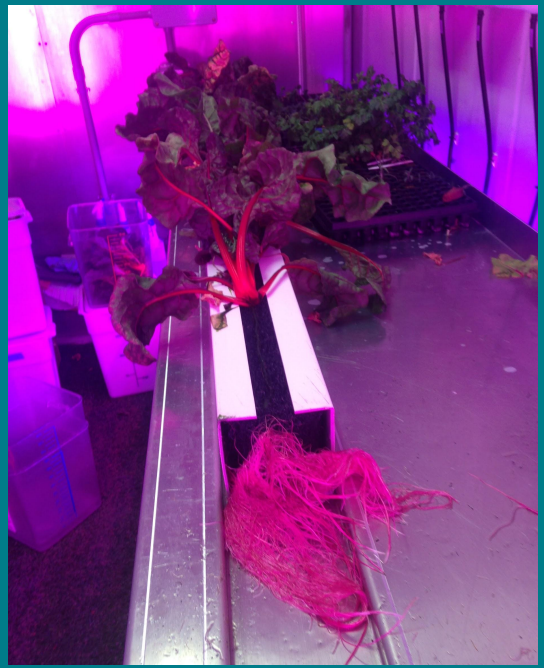
Photo credit Green Schoolyards America

The Basic Components for Hydroponics

Grow Medium

-Peat Moss
-Coconut Coir
-Expanded Clay Pellets
-Rockwool
-Perlite
-Vermiculite
-Gravel/Sand (Will work, but not ideal.)

Beautiful hydroponically grown chard being held in place by a peat moss plug and a plastic mesh grown medium.



SHS Freight Farm

The Basic Components for Hydroponics

A Reservoir and Distribution System

-Nutrient Film (Trough or Wick)
-Ebb and Flow
-Deep Water Culture (DWC)
-Aeroponic
-Drip Irrigation

Two hundred happy little lettuce seedlings developing in their ebb and flow tank.

Hydroponically grown radishes laying on their wicking strip.

SHS Freight Farm

The Basic Components for Hydroponics

A Reservoir and Distribution System

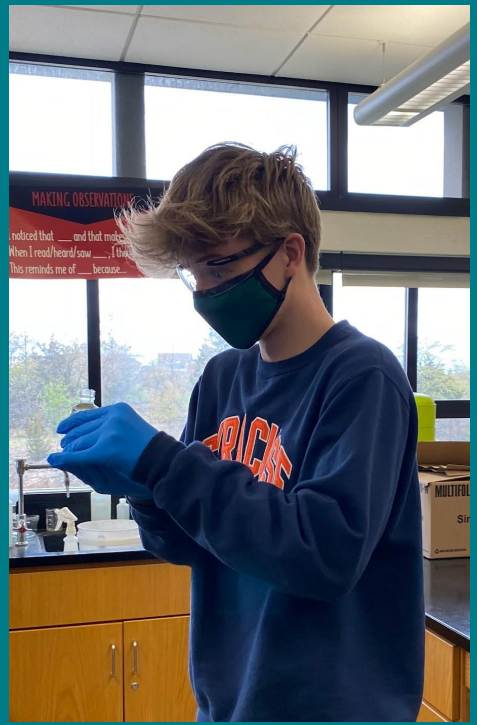
Nutrient film (left side of image) being fed by nutrient reservoirs.

Ebb and flow grow buckets (bottom center of image) being fed periodically from 55 gallon drum reservoir (right side of image).

SHS Hydroponics Lab

The Basic Components for Hydroponics

Student testing hydroponic water quality.



SHS Environmental Science

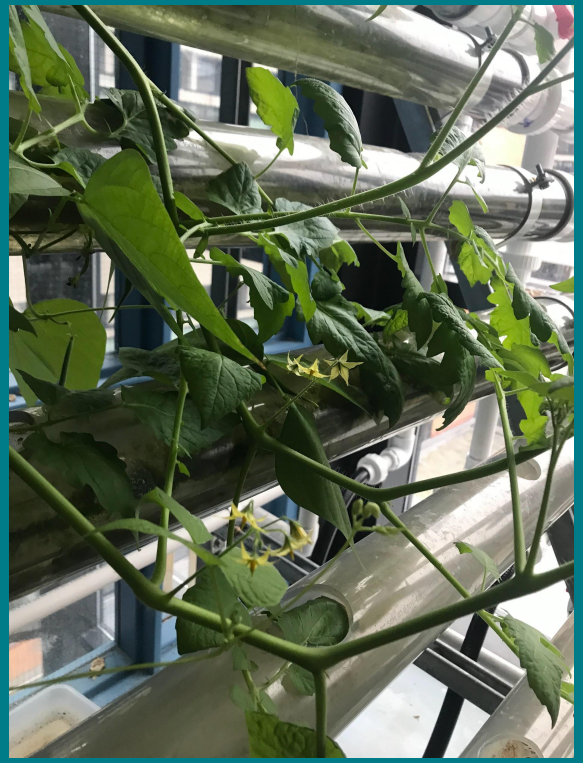
Nutrients and Water

Nutrients can be purchased as a liquid concentrate or dry mix.
-N (Nitrogen)
-P (Phosphorus)
-K (Potassium)
-micronutrients

Water quality should be monitored for optimum plant health and growth.
-Conductivity (nutrients)
-pH
-Oxygen

The Basic Components for Hydroponics

Exploring pollination with hydroponic cherry tomatoes.



SHS Environmental Science

Plants

Consider your needs and timeline.

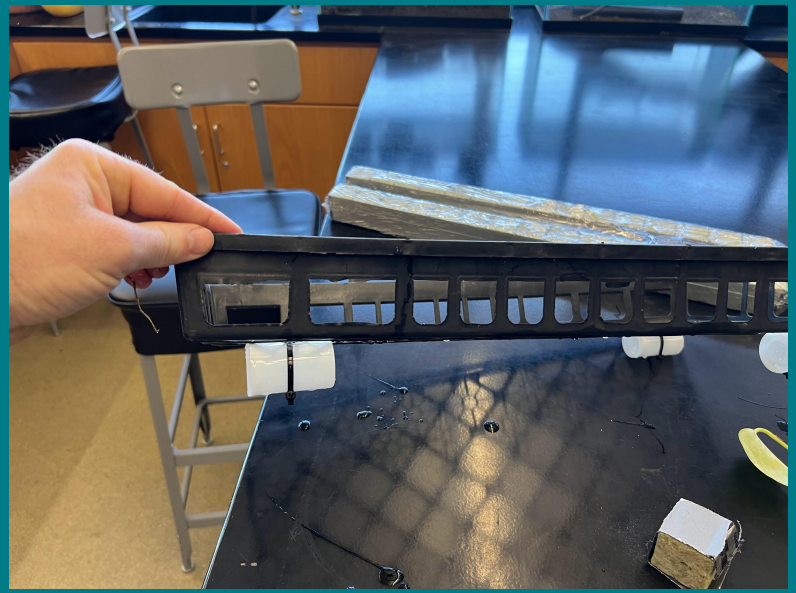
-Bean plants
    -grow quickly and tend to respond well to hydroponic conditions

-Leafy greens
    -germinate quickly and will bolt in warm conditions to the flowering stage if you are exploring the plant life cycle

-Fruiting plants
    -allow for opportunities to adjust nutrients and light to meet individual needs

A few examples of some introductory classroom setups.

Aquaponic “raft”



“Deep” water culture.

Rooted in the Standards

Life Sciences (LS):

LS1: From Molecules to Organisms: Structures and Processes - Students can learn about the structures and functions of plants, including how they obtain nutrients and water, through hydroponics.

LS2: Ecosystems: Interactions, Energy, and Dynamics - Hydroponics provides a hands-on way for students to understand the interdependence of organisms in ecosystems and how nutrients cycle through them.

LS3: Heredity: Inheritance and Variation of Traits - Students can explore how different plant varieties exhibit variations in traits such as growth rate, leaf shape, and color in a hydroponic system.

Physical Sciences (PS):

PS1: Matter and Its Interactions - Students can learn about the properties of water and other nutrients used in hydroponics, as well as the physical and chemical processes involved in nutrient uptake by plants.

PS3: Energy - Hydroponic systems can be used to demonstrate energy flow within ecosystems, including how plants convert light energy into chemical energy through photosynthesis.

Earth and Space Sciences (ESS):

ESS2: Earth's Systems - Students can explore the role of water in hydroponic systems and how human activities, such as agriculture, can impact Earth's water cycle.

ESS3: Earth and Human Activity - Hydroponics provides a context for discussing sustainable agriculture practices and their implications for resource management and environmental sustainability.

Photo credit Green Schoolyards America

Rooted in the Standards

Engineering Design (ETS):

ETS1: Engineering Design - Students can design and build their own hydroponic systems, applying principles of engineering design to optimize factors such as nutrient delivery, water circulation, and plant support structures.

Crosscutting Concepts (CCC):

Patterns - Students can analyze patterns in plant growth and nutrient uptake within hydroponic systems.

Cause and Effect - Hydroponics allows students to investigate the relationships between environmental factors (e.g., light, temperature, nutrient concentration) and plant growth.

Systems and System Models - Students can develop and use models to represent the inputs, processes, and outputs of hydroponic systems.

Photo credit Green Schoolyards America

Curricular Connections

Questions

Photo credit Green Schoolyards America

ADDITIONAL RESOURCES & LEARNING OPPORTUNITIES

- Mass. Farm to School - www.massfarmtoschool.org - Subscribe to our newsletter and stay up to date on upcoming webinars and other professional learning opportunities

- "Exploring Hydroponics: A Classroom Lesson Guide." National Farm to School Network.
- "Hydroponic Gardens for Classrooms: Your Beginner's Guide." ZipGrow Inc.,

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