Hydroponics in the Classroom

2011 National Agriculture in the Classroom Conference

Cindy Davidson
Youth Environmental Alliance

What is hydroponics?

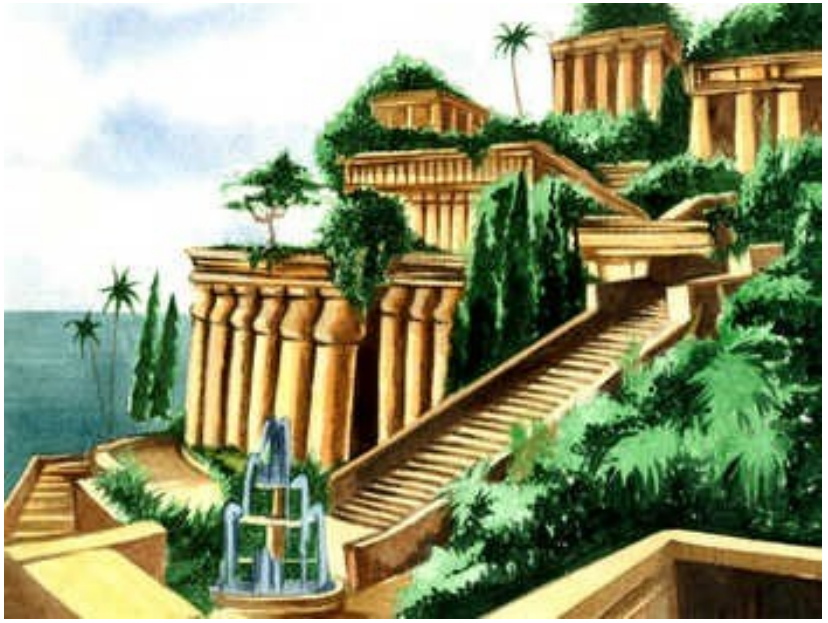
The Greek word “hydro” means water and “ponos” means labor or work.

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.

History of Hydroponics

Many different civilizations have utilized hydroponic growing techniques throughout history.

The floating gardens of the Aztecs of Mexico



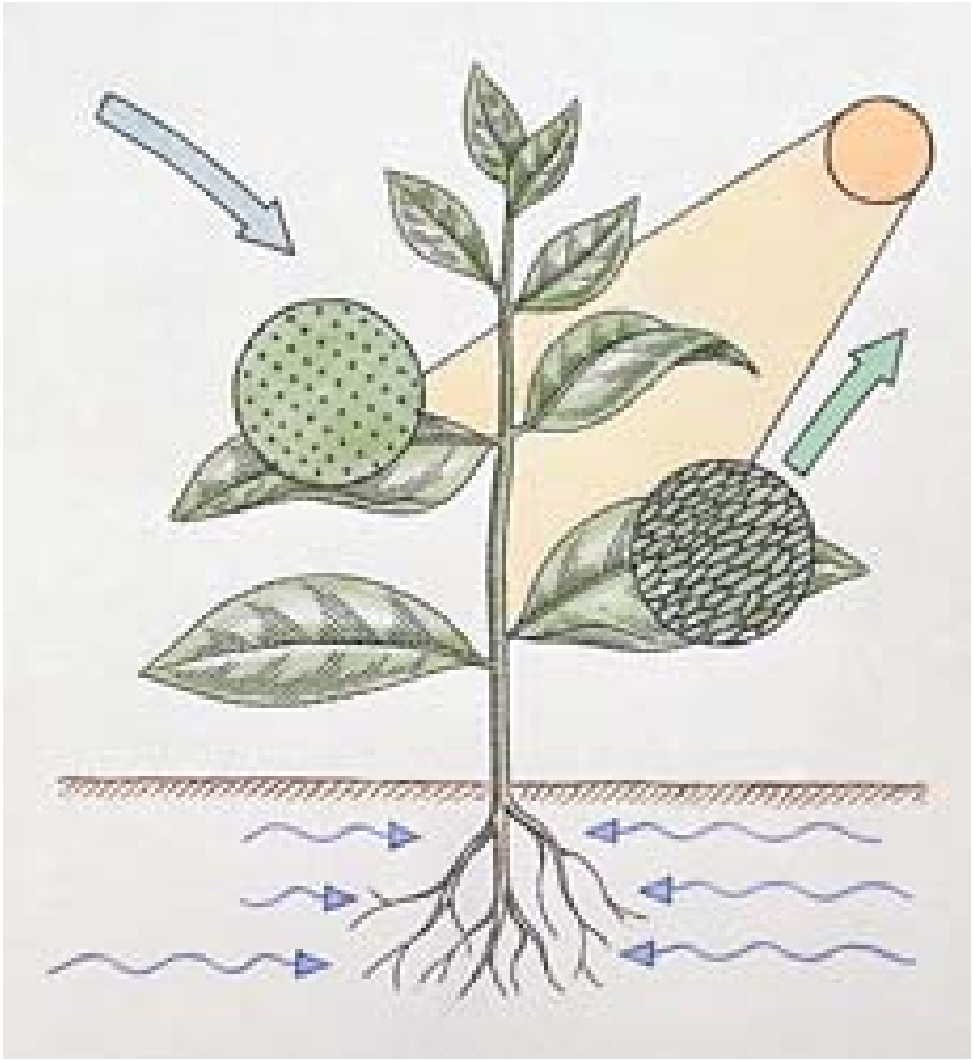
The hanging gardens of Babylon

Egyptian hieroglyphic records dating back several hundred years B.C. describe the growing of plants in water.

Hydroponics Today

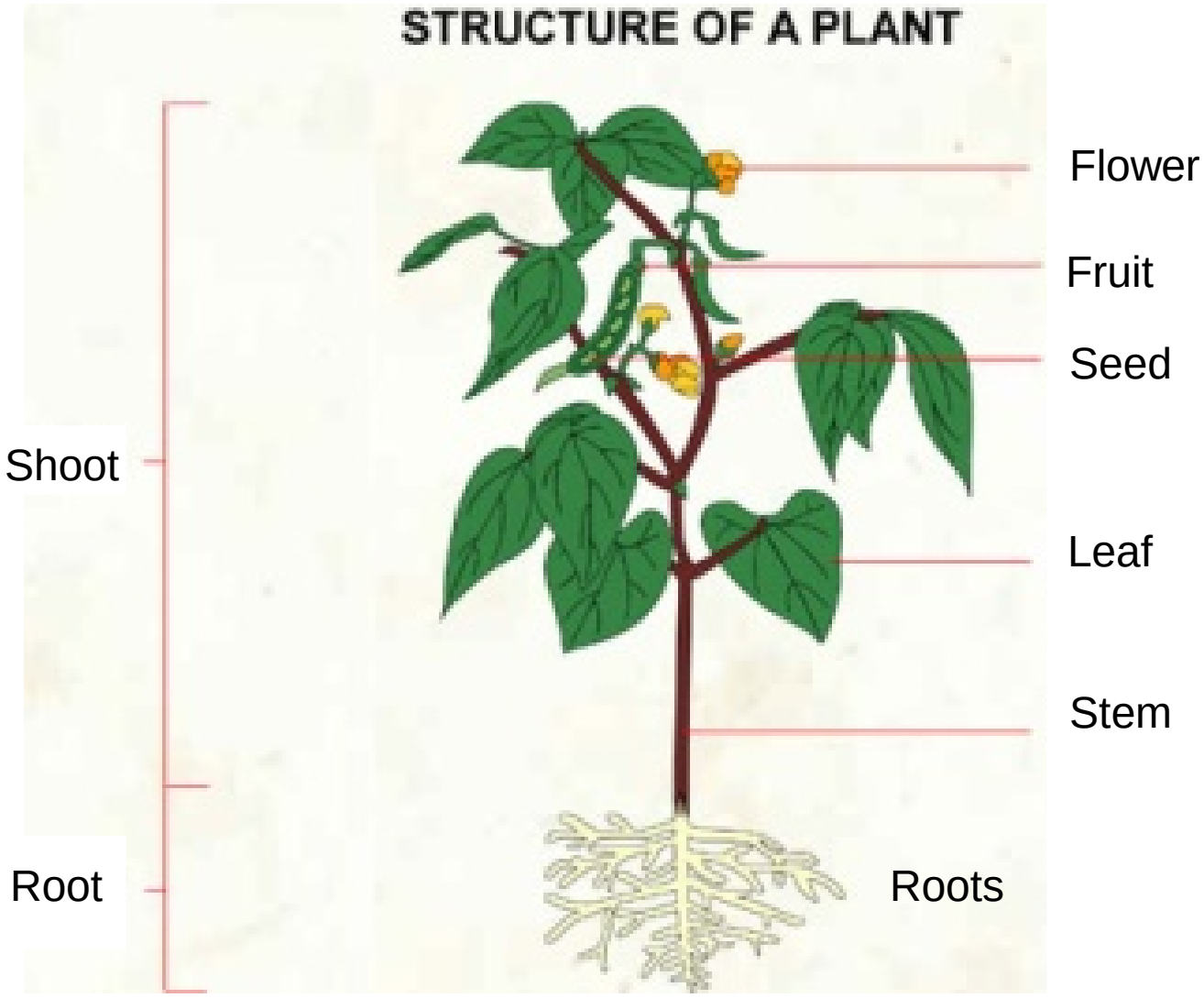
Hydroponics is hardly a new method of growing plants. Throughout the last century, scientists and horticulturists have experimented with many different methods of hydroponics.

Plant Needs



- **Water**
- **Nutrients**
- **Light**
- **Air**
- **Structural Support**

Plant Structure



Nutrients Basics

Mineral nutrient elements are divided into 2 groups.

MACRO nutrients

Primary:	Nitrogen (N)	Phosphorous (P)	Potassium (K)
Secondary:	Calcium (Ca)	Magnesium (Mg)	Sulphur (S)

MICRO nutrients

Iron (Fe)	**Boron (B)**	**Zinc (Zn)**	**Copper (Cu)**
Manganese (Mo)	Sodium (Na)	Chlorine (Cl)	Cobalt (Co)

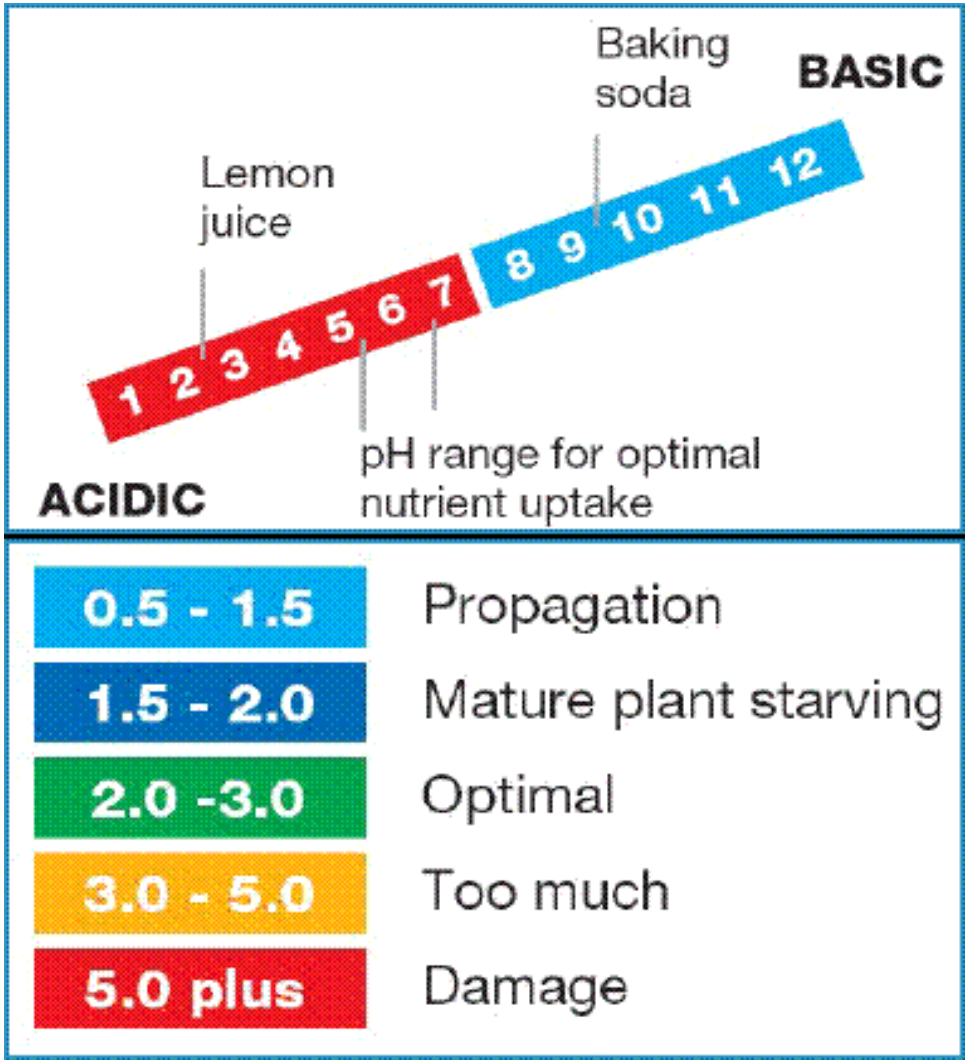
Feeding Plants

- Commercial hydroponic fertilizers: Advantage--excellent quality and reasonable cost. Disadvantage--difficult to find.

- Specialty fertilizers from hydroponic shops: Advantage--good quality, many come in liquid form, and are available almost anywhere. Disadvantage--expensive.

- Water soluble fertilizer: Advantage--reasonable cost and good availability. Disadvantage--All have something in them that is not ideal for hydroponics.

pH


Baking soda
BASIC
Lemon juice
1 2 3 4 5 6 7 8 9 10 11 12
ACIDIC
pH range for optimal nutrient uptake
0.5 - 1.5
Propagation
1.5 - 2.0
Mature plant starving
2.0 -3.0
Optimal
3.0 - 5.0
Too much
5.0 plus
Damage

pH Values For Different Hydroponic Crops

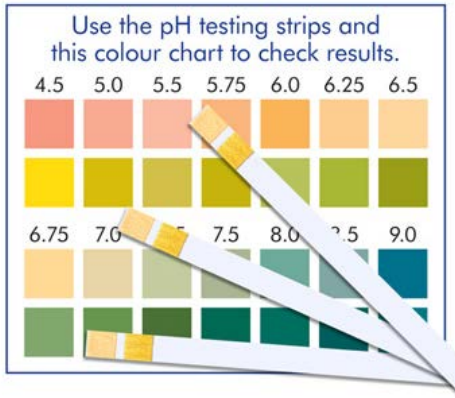
(From Hydroponic Food Production
by Howard M. Resh Woodbridge Press, 1987)

Plant	pH Range
Beans	6.0-6.5
Broccoli	6.0-6.5
Cabbage	6.5-7.5
Cantaloupe	6.5-6.8
Carrots	5.8-6.4
Chives	6.0-6.5
Cucumbers	5.8-6.0
Garlic	6.0-6.5
Lettuce	6.0-6.5
Onions	6.5-7.0
Peas	6.0-6.8
Pineapple	5.0-5.5
Pumpkin	5.0-6.5
Radish	6.0-7.0
Strawberries	5.5-6.5
Tomatoes	5.5-6.5

pH Testing

Methods used to test pH:

- Paper test strips
- Liquid pH test kits
- Digital meters



Methods used to adjust pH:

- phosphoric acid – lower pH
- Potassium hydroxide – raise pH
- Food grade citric acid
- Vineger - lower pH
- Baking soda – raise pH
- Hydroponic pH adjusters

Types of Systems

- Active
- Passive
- Media-based
- Water culture

Media-based Systems

Floating raft

Ebb-and-flow

Water culture Systems

Growing Media

Commonly used growing media for hydroponic culture:

- Coconut Fiber
- Expanded Clay
- Perlite
- Rockwool
- Sand
- Vermiculite

Light

Plants

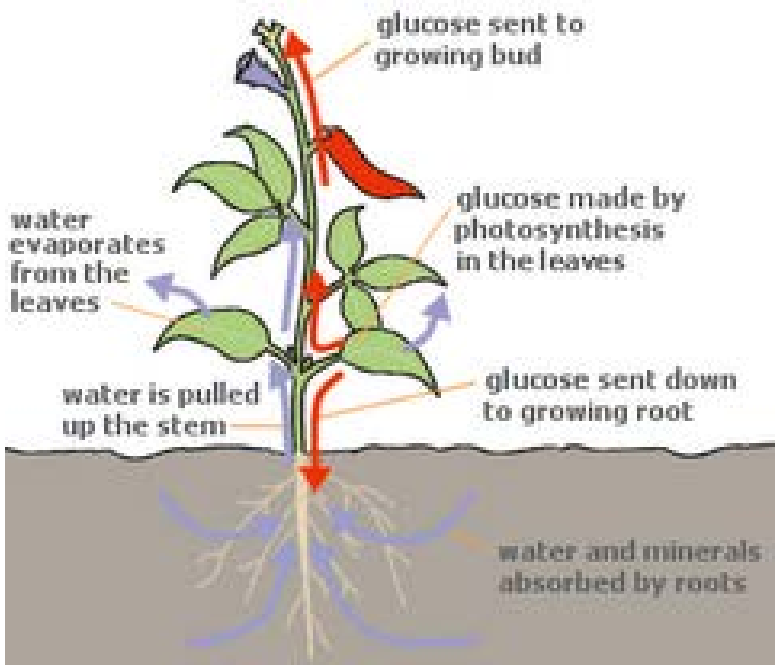
Growing

Plants can grow quickly using hydroponic methods. Keep a log of how your plants grow.

Why Teach Hydroponics?

Hydroponics is applicable in many classrooms– from kindergarten to college. Here are just some subject matters that can be covered:

- **Biology:** understanding photosynthesis, experiments with pH and nutrients, microbes and root development, light color spectrum effects, etc.



Why Teach Hydroponics?

- **Chemistry:** Interaction of various nutrients, pH adjusting, calculating ppm of nutrients, etc.

- **History:** Ancient history and hydroponics, scientific pioneers of hydroponics

Why Teach Hydroponics?

- **Math/Business**: sell cuttings/seedlings for school project; calculate cost to produce and selling price.

- **Geography**: Research plants from around the world

- **Engineering/Physics**: system designs, capillary movement

Sawgrass Springs Middle School

Grow it Green Project

Sawgrass Nature Center

G.O.A.L. Project

Coral Glades High School

Seed to Table Project

Hunt Elementary School

Earth Patrols

Resources

Kidsgardening.org
http://www.kidsgardening.com/HYDROPONICSGUIDE/hydro1-1-intro.asp

Growing Edge
http://www.growingedge.com/basics/tutorial/01_history.html

S.H.A.R.P. Lesson Plans for Hydroponics
http://library.thinkquest.org/C0110342/lessonplan

Resources

Supply sources:

- Growers Supply
- Sunlight Supply Inc.
- Verti-Gro
- HYDRO-STACKER
- Home Depot

Table Top Hydroponic

Table Top Hydroponic

Contact Information

Cindy Davidson
Youth Environmental Alliance
954-649-7717
cindy@yeafrog.org