Hydroponics in the Classroom

Hydroponics

- Hydroponics is a method of growing plants without soil, using water
- The water must be enriched with nutrients
- The plants must also have something to support the root system

Plant Needs

- Water
- Nutrients
- Light
- Air
- Structural Support

Nutrient Basics

- Mineral nutrients are divided into two groups
  - Macro Nutrients
  - Micro Nutrients

Macro Nutrients

- These are divided into primary and secondary nutrients
  - Primary: Nitrogen (N), Phosphorous (P), and Potassium (K)
  - Secondary: Calcium (Ca), Magnesium (Mg) and Sulphur (S)

Micro Nutrients

- These are:
  - Iron (Fe)
  - Boron (B)
  - Zinc (Zn)
  - Copper (Cu),
  - Manganese (Mn)
  - Sodium (Na),
  - Chlorine (Cl)
  - Cobalt (Co)

Fertilizers

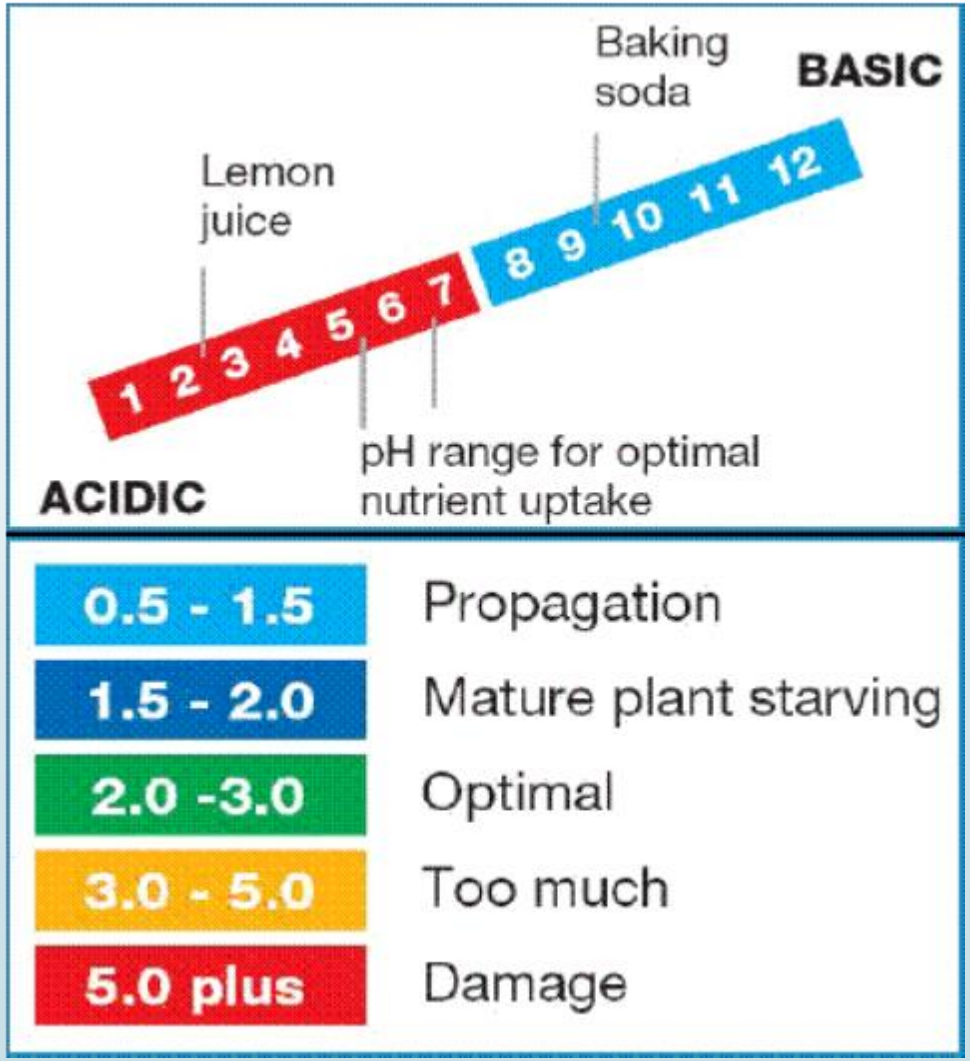
- Commercial Hydroponics Fertilizers
  - Advantage: High quality, reasonable price
  - Disadvantage: Difficult to find
- Specialty Hydroponics Fertilizers
  - Advantage: Good Quality, come as a liquid, widely available
  - Disadvantage: Expensive
- Water Soluble Fertilizers
  - Advantage: Reasonable price, good availability
  - Disadvantage: Not designed for Hydroponic Systems

What do we use?

- We will be using a Specialty Fertilizer: Hydro-Fuel
- There are two versions of this
  - Hydro-Fuel Grow and Hydro-Fuel Bloom
  - The version we use depends on which stage of life the plants are at.
- Nutrient water will be premixed for each station and located at the back of the room

pH

- pH is a scale to measure the overall acidity or basicity of a solution
- pH is measure from 1 – 12, with 7 being approximately neutral
- Different plants like different pH levels
- A plant's roots may change the pH of the water to suit its needs



pH Testing

- There are many different ways to measure pH
  - We will be using digital test meters
- We can also adjust the pH of the water
  - Phosphoric acid – lowers pH (becomes more acidic)
  - Potassium Hydroxide – raises pH (becomes more basic)
  - Vinegar – lowers pH
  - Baking Soda – raises pH

Test Meters

- When not in use, the test meters must be stored properly
  - They must either be submerged in water or be stored in the proper container with the test solution
- We have two different types of test meters

Our Systems

- Armstrong tap water has a pH of about 8.6
- The pH range for Hydroponics systems is from about 5.5 – 6.5
  - The ideal pH for Hydroponics systems is 5.8
- This means that we must bring the pH of the water down before it can be used in most systems.
  - We use regular tap water in Aquaponics
- We use the term pH neutral water to refer to water that is around the target of 5.8 pH
- We will use pH neutral water to top up our systems as needed

Growing Media

- Plants need additional structure for their root systems
- There are many options for growing medium in a hydroponic system
  - Coconut Fiber
  - Expanded Clay (Hydro-Corn)
  - Perlite
  - Rockwool
  - Sand
  - Vermiculite
- We use Hydro-Corn in most of the systems

Light

- Plants need light to grow and survive
- In the hydroponics room, the lights are run on timers
  - The light schedule is set to mimic daylight
- These lights are extremely bright and hot to the touch
  - Prolonged exposure to high intensity lights can cause headaches and eye damage
  - This is why sunglasses are recommended while working in the Hydroponics lab

Why take Hydroponics?

- Hydroponics incorporates many different aspects from multiple fields of study
  - Biology: photosynthesis, nutrient cycles, microbes and root development
  - Chemistry: Interaction of nutrients, pH adjusting, and the mixing of nutrient water
  - History: ancient history and hydroponics
  - Geography: research of plants from around the word
  - Engineering/Physics: systems design and capillary movement