Set it & Forget it Hydroponics!

Presentation by Hannah Wooten
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UF | IFAS Extension
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ORANGE COUNTY GOVERNMENT
FLORIDA

Welcome!

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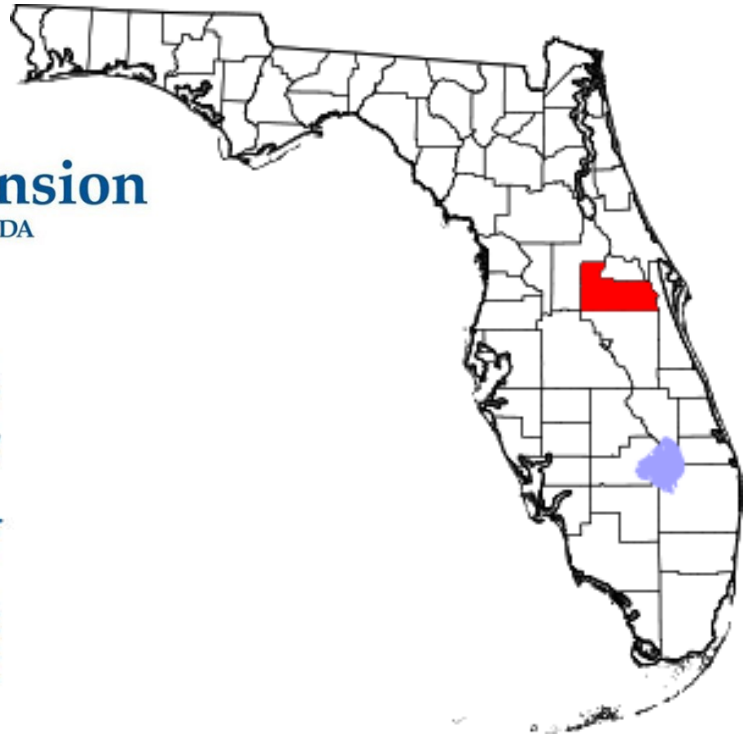


Overview

- Define hydroponics
- History of Hydroponics
- Why use hydroponics?
- Science of Hydroponics
- Set it and forget it hydroponics success!

Hydroponics

- Hydroponics is derived from the Greek words:
  - Hydro = water
  - Ponos = labor
- Method of growing plants without soil using mineral nutrient solutions grown:
  - Directly in water

  OR
  - In inert medium like perlite, gravel, or mineral wool

History of Hydroponics

- 600 BC- Hanging Gardens of Babylon
- ~1300 AD- Aztec “chinampas”
- 1850’s- Sachs made advances in botany
- Knop became “Father of Water Culture”
- 1930’s- UC Dr. Gericke coined “hydroponics”
- 1945- WWII hydroponic farms on Ascension Island provide fresh produce to soldiers
- 1948- University of Kentucky Prof. Emmert considered “father of plastics”
- Advancements in botanical research
- Technology like pumps, time clocks, plastic plumbing, solenoid valves, and artificial lighting allowed automation

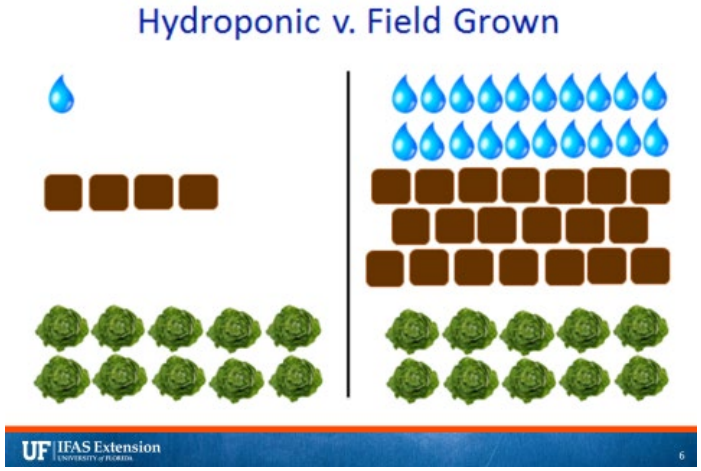
Aztec chinampas

Ascension Island Airforce Auxiliary hydroponic greenhouses still supply island with fresh produce ←1945 & 2019↓

Benefits of Hydroponics

- Up to 95% less water used
- Up to 80% less space used to achieve same yields
- Efficient fertilizer use
- 2X faster grow cycle is achievable in some cases
- No herbicides or weeding- reduced use of pesticides
- Successful on non-arable land:
  - Urban areas, indoors, brownfields, unsuitable climate
- Go vertical
- Self-sustained city- based food system with less strain on distant farms, transportation, carbon emissions, and habitat


Vertical Farm in Singapore

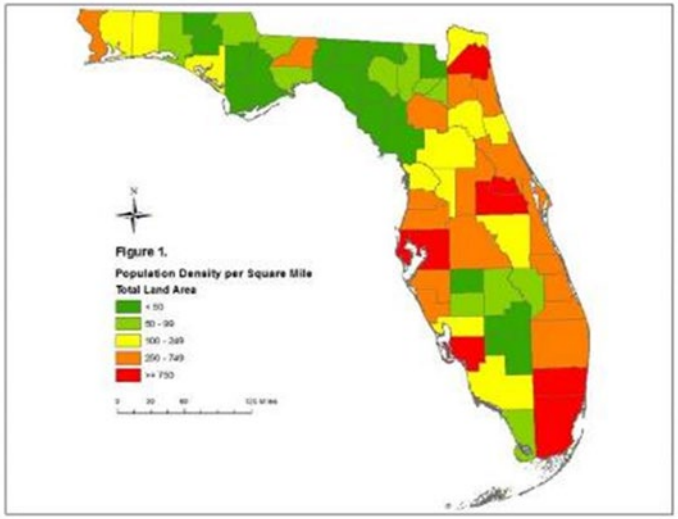


The Global Food Situation

- The population is expected to increase from 7 billion to 9.5 billion people by 2050
- Currently, 1 billion people suffer from hunger
- Habitat loss is the leading cause of biodiversity loss
  - 38% of land is currently used for agriculture

The Florida Food Situation

- Florida produces second highest vegetable value in US
- Agriculture is second largest industry in Florida
- Farms in urbanizing counties face special challenges for long term sustainable solutions

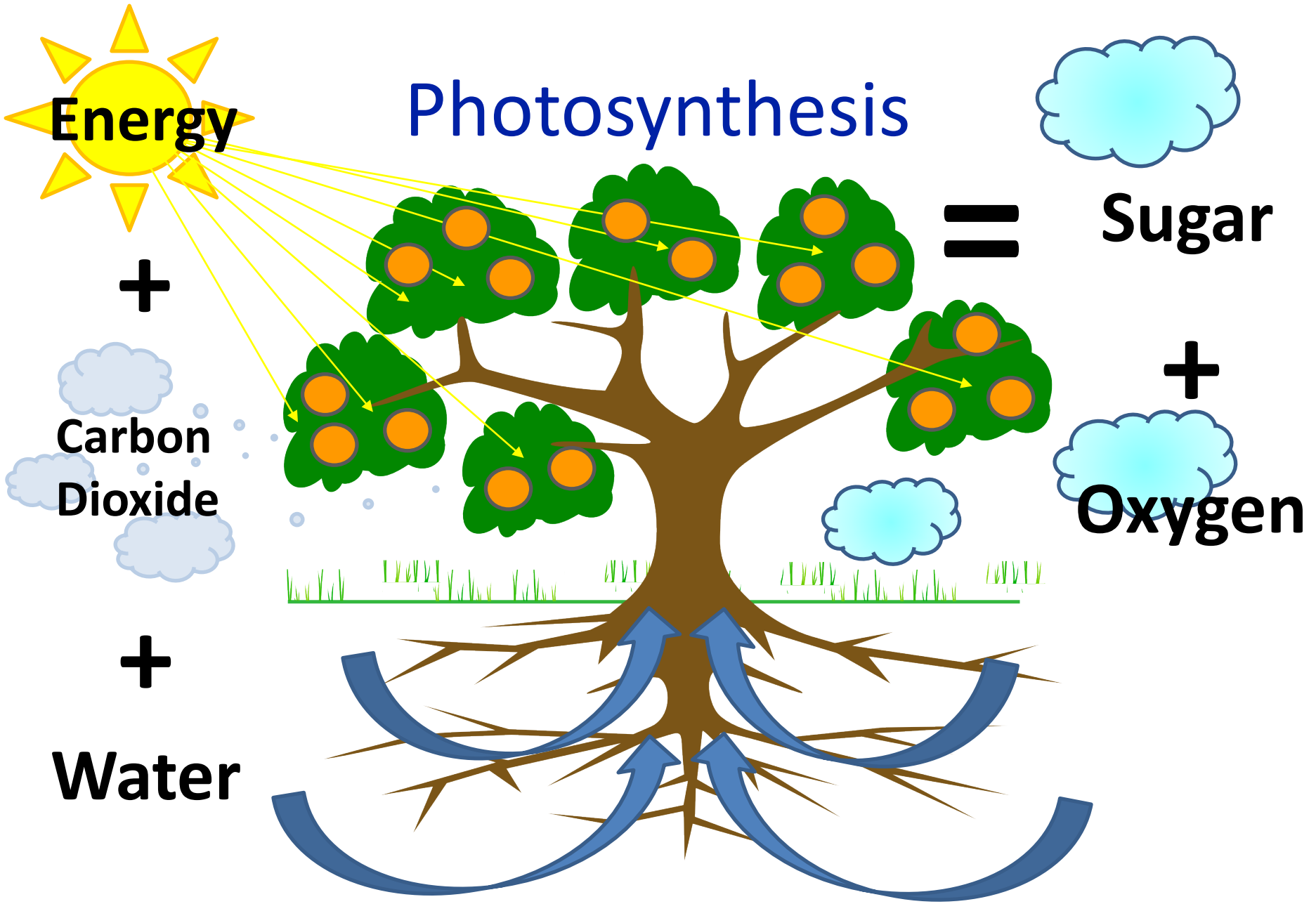


Hydroponic Growing

- Photosynthesis
  - the process by which plants make their own food

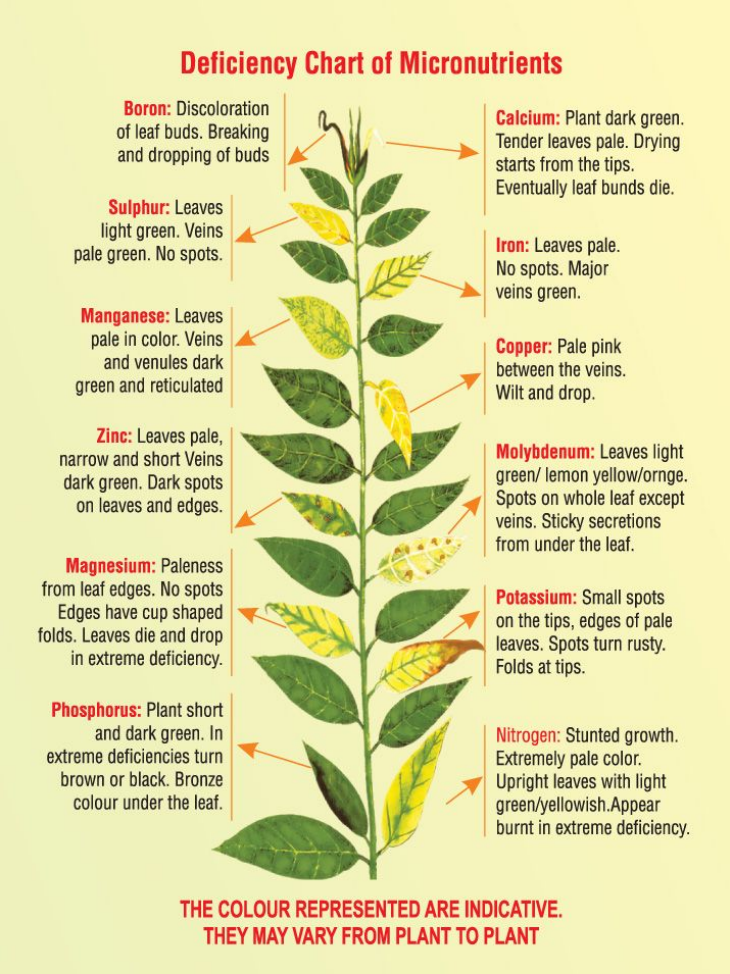
- Nutrient uptake
  - Necessary for plant growth- 17 nutrients
  - A plant cannot complete its normal life cycle in the absence of an essential plant nutrient
  - Nutrients are obtained through the water, air, or soil
    - **In hydroponics, all of the nutrients must be supplied to the plant**
  - **pH must be balanced for nutrient uptake to occur**
- Support/ anchor for plant and roots
- Air space and oxygen for plant roots

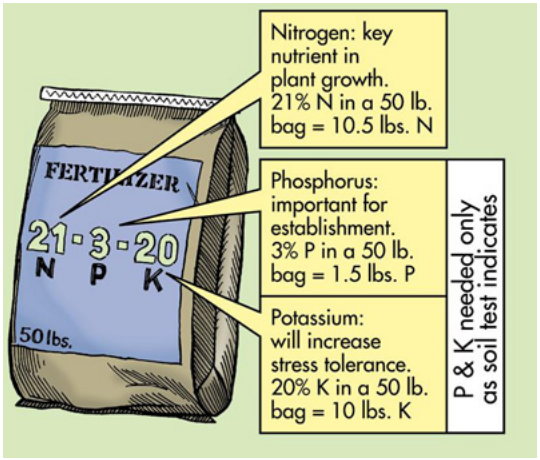
Photosynthesis

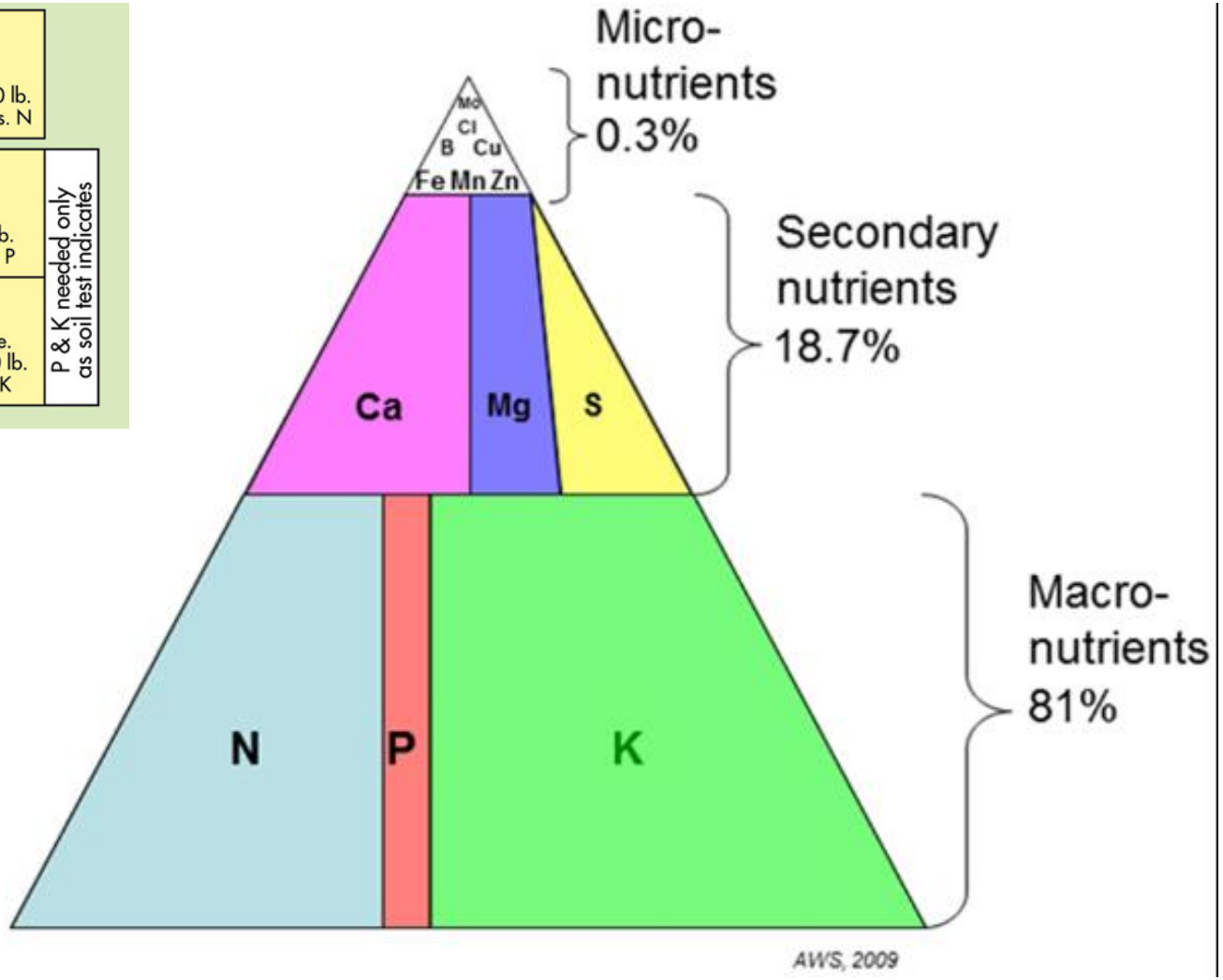


Nutrients

- **Essential nutrients**
  - Carbon, hydrogen, and oxygen come from the air and water
  - Nitrogen, phosphorus, and potassium are primary nutrients used heavily by the plant
  - Calcium, magnesium, and sulfur are secondary nutrients that may be available in the soil
    - Need to supplement in hydroponics
  - Iron, zinc, molybdenum, manganese, copper, cobalt, boron, and chlorine are micronutrients that are required in trace amounts







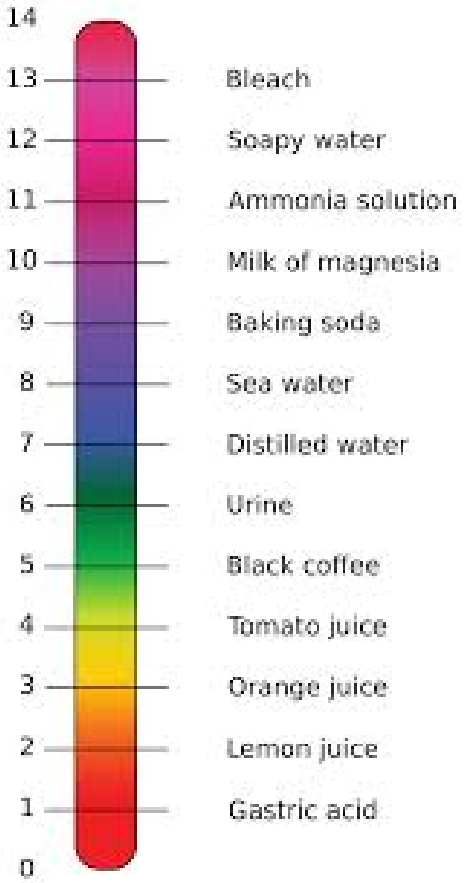
Representation of percentage of essential nutrients required for healthy plant growth. This figure represents nutrient needs for citrus.

Nutrients

- **Measured in two ways:**
- **Electrical Conductivity- EC**
  - Used almost exclusively by commercial hydroponics growers
  - Used almost exclusively in UF/IFAS documents
  - Unambiguous measurement, industry standard, no conversions
  - Meters available online
- **Total Dissolved Solids- TDS**
  - Used frequently by hobby hydroponic growers
  - Sold in hobby hydroponics stores and online
  - TDS regularly referred to online in forums, etc.
  - Ambiguous measurement, calibrated in at least two ways
- **READ THE LABEL**

Nutrient Uptake

- Nutrient ion must be present adjacent to the root
- Impacted by pH
  - pH is a number on a scale of 1-14 used to specify how acidic or basic an aqueous solution is
- pH of 5.6- 6.0 is optimal for hydroponic lettuce nutrient uptake
  - pH above or below could “lock out” some essential nutrients
  - Could show signs of nutrient deficiency



Target Nutrient Levels and pH

- If using measurement tools, these are your target ranges
- EC or TDS meter not required for basic hydroponics
  - Necessary for intermediate and advanced hydroponics

	Source Water (before adjustments)	**Nutrient Solution** (after adjustments)	**Goal Ranges**
Electrical Conductivity (EC)/ Total Dissolved Solids (TDS)			EC~ 1250 µS/cm TDS~ 800 ppm
pH			pH~ 5.6- 6.0

Set It and Forget It!

Carbon dioxide

Support/ anchor

Air space/ Oxygen

Water

- Nutrients
- pH balanced







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Hydroponic Lettuce Hannah Wooten

Resources

- http://i.unu.edu/media/ourworld.unu.edu-en/article/5340/VerticleFarmPlot.jpg
- http://sustainable-farming.rutgers.edu/wp-content/uploads/2014/01/hydroponics.png
- http://www2.dickinson.edu/storg/sisa/clip_image004.jpg
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