

Set It and Forget It Hydroponics

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University of Florida Extension

- Partnership between University of Florida & County Governments
 - All 67 counties in Florida have an Extension presence
 - Most have a Residential Horticulture Agent, Commercial Agriculture Agent, Family & Consumer Sciences Agent, and 4-H Youth Development Agent



Objectives

Today:

- Prepare nutrient solution for hydroponic lettuce using pH and EC as measurement tools
- Schedule planting and harvest schedule for lettuce through the growing season

When you get home:

- Plant, harvest, and consume hydroponic homegrown lettuce continually
- Increase lettuce consumption

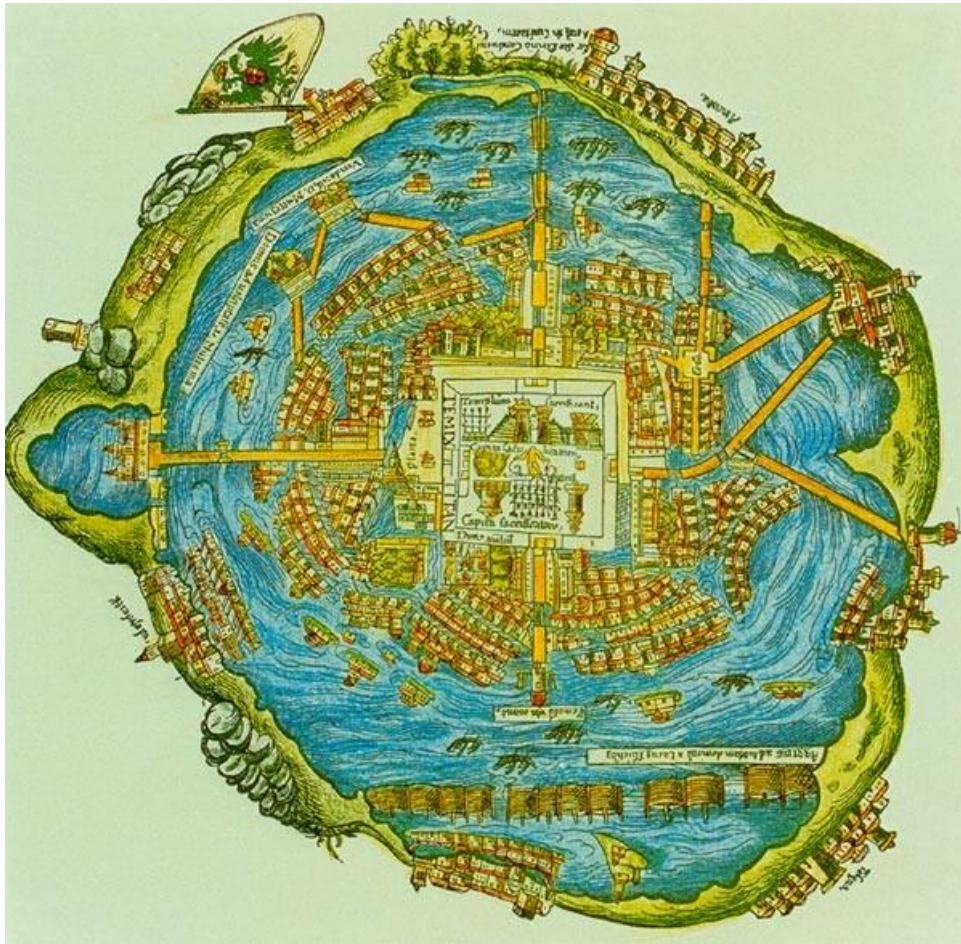
Hydroponics

- Hydroponics is derived from the Greek words:
 - Hydro = water
 - Ponos = labor
- Method of growing plants without soil using mineral nutrient solutions grown:
 - Directly in waterOR
 - In inert medium like perlite, gravel, or mineral wool



History of Hydroponics

- 600 BC- Hanging Gardens of Babylon constructed by King Nebuchadnezzar
- ~1300 AD- Aztec “chinampas” floating gardens in Central Mexico
- 1850’s- Sachs advanced understanding of botany and Knop became “Father of Water Culture”
- 1930’s- University of California Dr. Gericke coined term “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

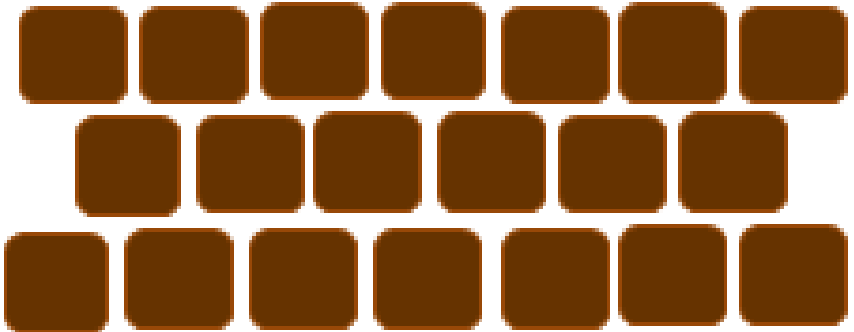


Aztec “Chinampas”

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
- No herbicides or weeding- reduced to eliminate 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

Hydroponic v. Field Grown





Vertical hydroponic bibb lettuce



Deep Water Culture basil



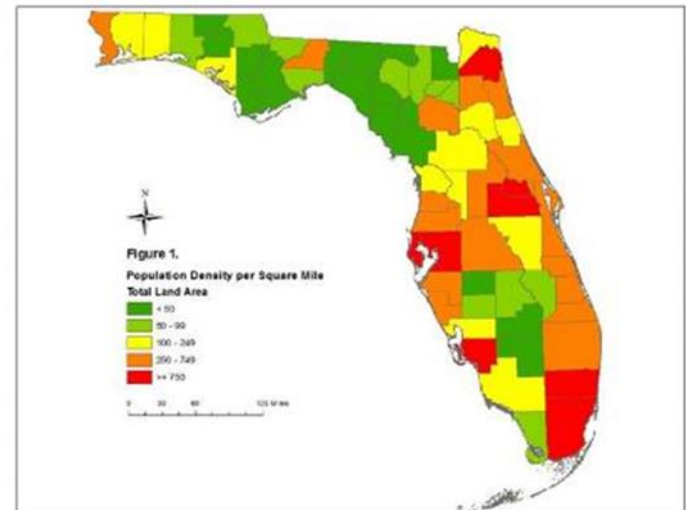
Vertical Farm in Singapore

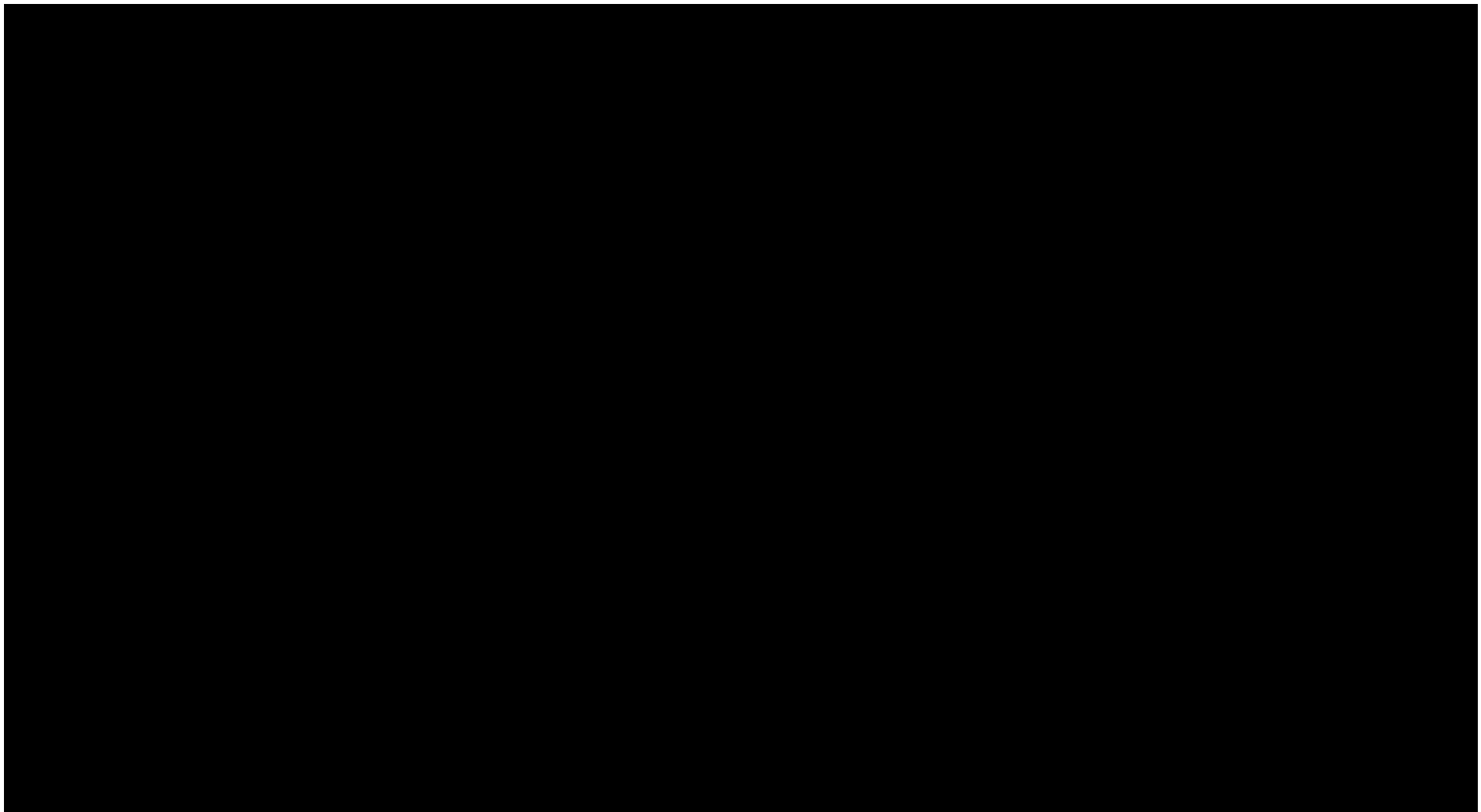
The Global Food Situation

- 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



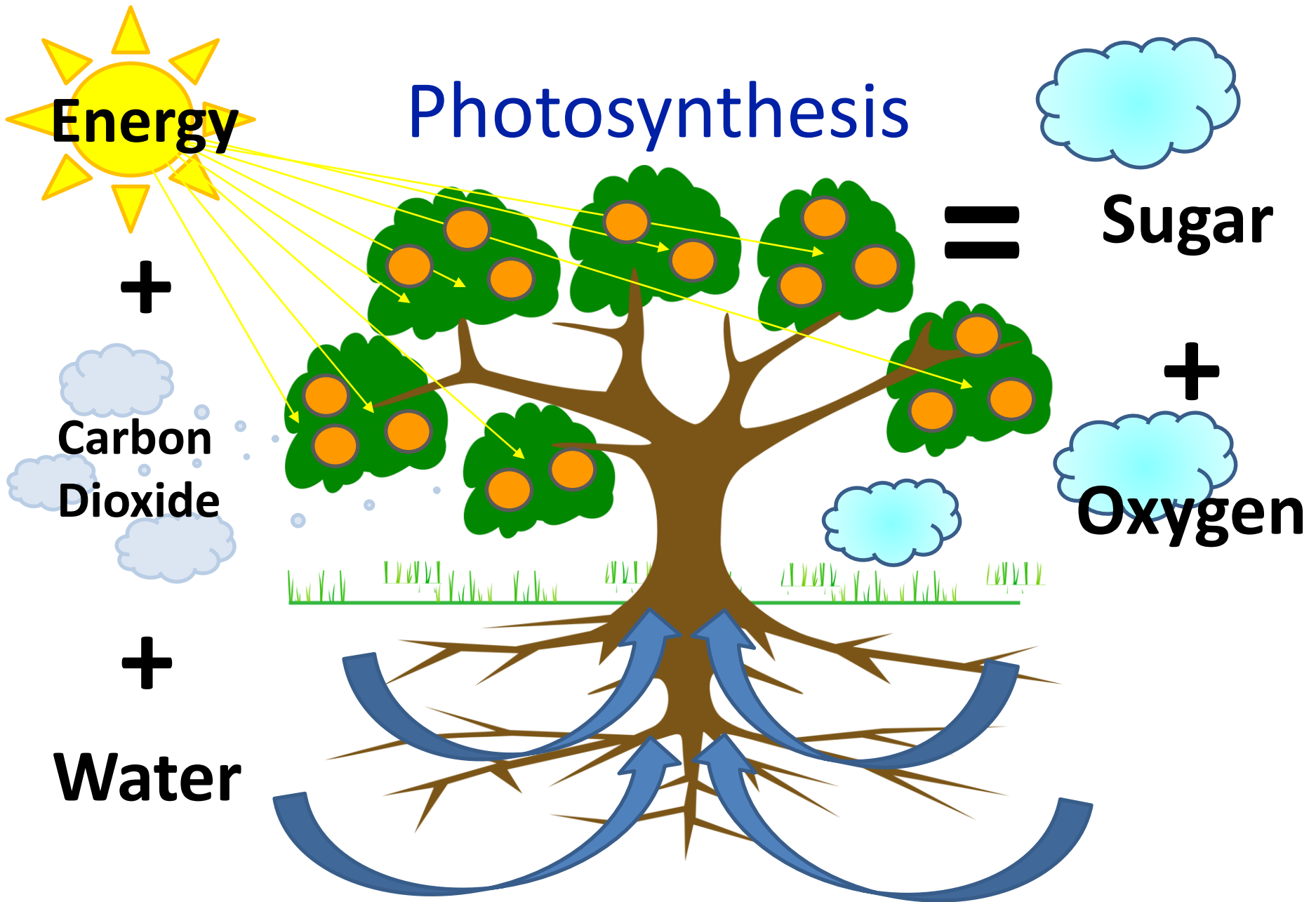


Hydroponic Growing

- 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



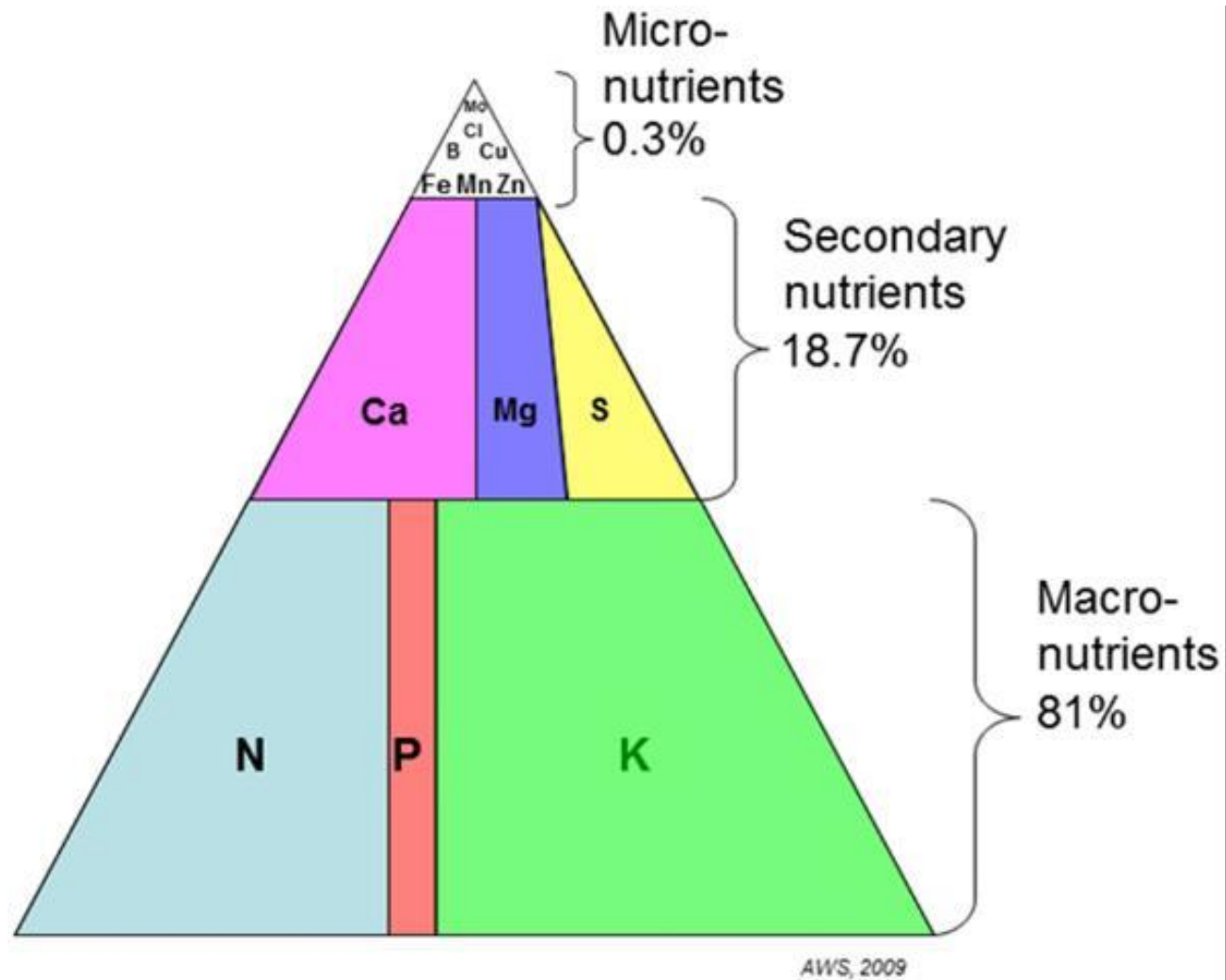
Nutrients

- **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

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**



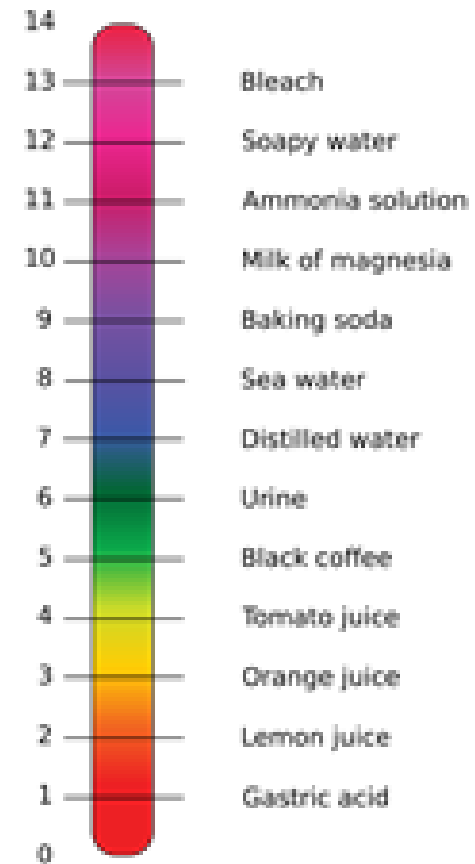
Representation of percentage of essential nutrients required for healthy plant growth. This figure represents nutrient needs for citrus.

Nutrient Uptake

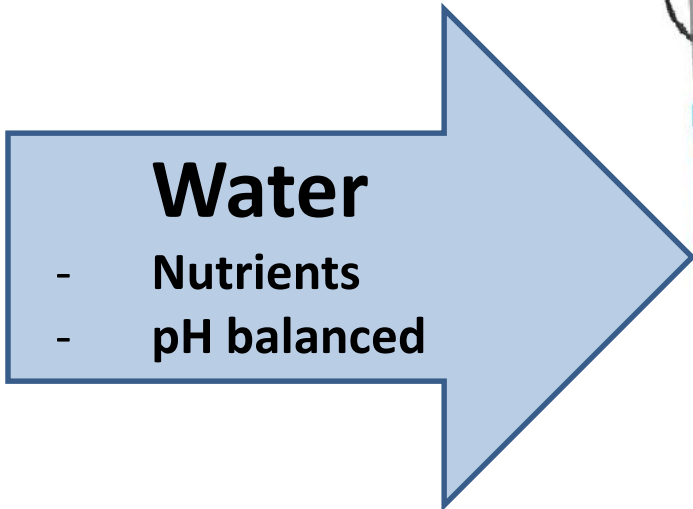
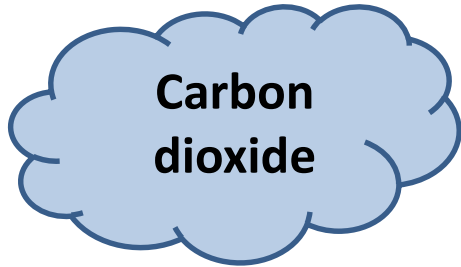
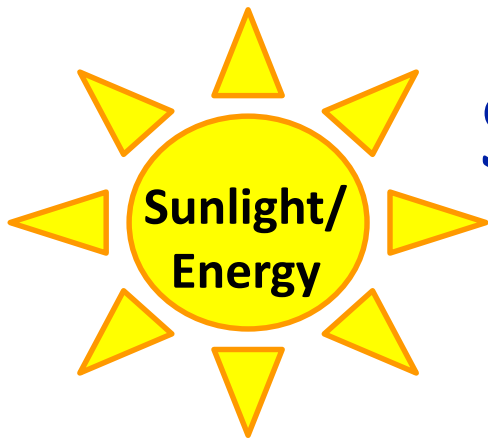
- Nutrient ion must be present adjacent to the root
- Impacted by pH
 - pH is a number on a scale of 1-14 used to specify how acidic or basic an aqueous solution is
- pH of 5.6- 6.0 is optimal for hydroponic lettuce nutrient uptake
 - pH above or below could “lock out” some essential nutrients
 - Could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

pH Scale

- pH is a number on a scale of 1-14
- used to show is something is acidic or basic
- pH of 5.6-6.0 is optimal for hydroponic lettuce
 - pH above or below could cause nutrients to be **LOCKED OUT**



Set It and Forget It!









UF UNIVERSITY of FLORIDA
IFAS Extension

SEMINOLE COUNTY
FLORIDA'S NATURAL CHOICE

Leisure Services Department **Seminole County Extension Services**

2019 Seminole County Farm Tour

FRIDAY, MARCH 22, 2019
8:30 a.m. to 5:00 p.m.

New THIS YEAR!

Tour all day in the comfort of a charter bus.

\$60 includes seat on charter bus, tour guide, 5 farmer-led visits, a farm-to-table lunch featuring a whole hog, and an unforgettable day!



Every family eats, therefore, every family needs a farmer. Do you know yours? Take this opportunity to meet, support, and learn from your Seminole County farmers and stewards of the land. Experience a sample of Seminole County's agricultural industry, past, present, and future!

Space is limited! Pre-registration required:
<http://2019seminolecountyfarmtour.eventbrite.com/>

Featured Farms Include:

- *The Yarborough Ranch*
- *Dutchmill Nursery*
- *John E. Polk Correctional Facility Hydroponic Greenhouse*
- *Morris Family Farms*
- *Ol' Barn Junktiques*

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For more information or questions, please email Hannah Wooten at hwooten@ufl.edu or call 407-665-5554.

Hungry for more?
Join me on the Seminole
County Farm Tour!

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Sustainable Agriculture &
Food Systems Agent

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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
- <https://www.britannica.com/biography/Julius-von-Sachs>
- http://www.ctahr.hawaii.edu/MauiSoil/c_nutrients.aspx
- <https://cals.arizona.edu/hydroponictomatoes/history.htm>
- <https://blogs.stockton.edu/aztecsociety/agriculture-and-exchange/>
- http://www.academia.edu/1587576/Mapping_ancient_chinampa_landscapes_in_the_Basin_of_Mexico_a_remote_sensing_and_GIS_approach
- http://edis.ifas.ufl.edu/LyraEDISServlet?command=getImageDetail&image_soid=FIGURE1&document_soid=HS184&document_version=97617
- <https://pixabay.com/en/tree-branches-root-eco-ecology-309046/>
- http://www.ctahr.hawaii.edu/MauiSoil/c_nutrients.aspx
- <https://www.agry.purdue.edu/ext/pubs/AGRY-95-08.pdf>